A TEXTBOOK OF HYGIENE FOR TRAINING COLLEGES

MARGARET AVERY

9s. 6d.

A TEXTBOOK OF HYGIENE FOR TRAINING COLLEGES

BY THE SAME AUTHOR

SIX GREAT SCIENTISTS
HEALTH: A TEXTBOOK FOR SCHOOLS

A TEXTBOOK OF HYGIENE FOR TRAINING COLLEGES

BY

MARGARET AVERY

B.Sc. London, M.R.San.I.

LATE VICE-PRINCIPAL OF WARRINGTON TRAINING COLLEGE

WITH 100 ILLUSTRATIONS

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PREFACE

THIS book, which is chiefly the outcome of lectures given to my students, covers the subject-matter of the Board of Education Certificate Examination for Training Colleges, and will, I hope, be of use not only to College students, but also in connection with the work done in the new Continuation Classes and elsewhere.

I have included chapters on Eugenics, Infant Welfare and Legislation affecting Children—subjects which are of such interest and importance to the community that some study of them should be included in the education of all who have reached adolescence.

I have tried always to use simple words and to suggest practical applications of theoretical knowledge wherever possible—being fully convinced of the futility of Hygiene which is not practised. The teacher who settles down to give a lesson on cleanliness in a class-room covered with dust is probably doing more harm than good. The class had better first dust the room—even though this be superficially suggestive of Mr. Squeers' methods of instruction.

I am indebted to various authors for information. As far as possible I have acknowledged my sources in the text, but I should like specially to mention here The Annual Reports of the Chief Medical Officer of the Board of Education (Sir G. Newman), Dr. Crowley's *Hygiene of School Life*, rewritten by Dr. Hutt, Dr. Kerr Love's *The Deaf Child*, Dr. J. Kerr's *School Hygiene*, Dr. Slaughter's *The Adolescent*, various articles in *School Hygiene* and the Journal of the Royal Sanitary Institute.

For illustrations, I have to thank Dr. G. Auden, Dr. C. W. Hutt, Mr. G. H. Widdows, F.R.I.B.A., the Committee of the Bristol Open-Air School, the Ling Association, the Abertillery Education Committee, and various publishers mentioned in the text.

M. A.

September, 1919.

PREFACE TO THIRD EDITION

In this edition I have added a chapter on the training of children in the practice of hygiene, some further information as to the dangers of tainted or adulterated food, and a short discussion of common beverages. The latter part of Chapter XI has been largely re-written, and some minor corrections have been made in various other parts of the book. These changes will, I hope, add to its value.

M. A.

October, 1920

PREFACE TO ELEVENTH EDITION

This edition contains seven appendixes, giving additional information on subjects, all of which are important, and in all of which knowledge has made recent advances.

These subjects are :— I Vitamines, II Constipation, III Influenza and Sleepy Sickness, IV Prevention of Diphtheria, V Clean Milk, VI Sunlight, Smoke and Health, VII Preservatives in Food.

M. A.

November, 1928.

PREFACE TO FOURTEENTH EDITION

In this edition the end of Chapter X has been re-written in order to give more recent information as to legal methods of enforcing Cleanliness. There is also a short account of the work of Child Guidance Clinics (p. 144) and of the instrument known as the Audiometer (Appendix VIII). Statistics in various places have been brought up-to-date.

M. A.

July, 1932.

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A TEXTBOOK OF HYGIENE FOR TRAINING COLLEGES

CHAPTER I

INTRODUCTORY

Scope—Gradation of structure in animals—The cell—Tissues of the body—Child's tissues immature—Factors influencing development: heredity, environment.

HYGIENE (Gk. hygieia=health) is essentially the science of health, or disease-prevention.

In health, every part of the body is doing its own work quietly, with no fuss—and one ought therefore in health to be nearly unconscious of one's body.

Disease is caused by interference with the working of some part of the body-mechanism, the disturbing cause being either internal or external. Hence, Hygiene comes to be largely a study of the conditions, both internal and external, which affect health, with the object of gaining control over those conditions, and so of making them as favourable as possible to the individual or, in other words, of giving every one the best chance possible of living a really complete life—physically and mentally. Now, it is fairly obvious that no study of external or internal conditions of life can be intelligent without some grasp of the mechanism on which these conditions act, and so the preliminary to Hygiene is the study of the *structure* of the body and the *functions*, or work, of its parts. Technically these two subjects are known as Anatomy and Physiology (Gk. *ana*=up; *temno*=I cut); (Gk. *phusis*=nature; *logos*=discourse).

As you know, the animal kingdom shows a gradation of complexity of structure, from an animal consisting of a single microscopic cell, which performs all the vital functions, up to an animal like Man, consisting of millions of cells of different kinds, each kind doing one particular bit of work, so that the existence of the whole depends on the efficient working of each kind of cell. The study of the cell, since it is the unit or brick from which every animal is built, is therefore the starting-point in anatomy, and it can well be begun on one of the very simple animals mentioned above, e.g. the amœba, found in the water of ponds, ditches, etc. This consists of one cell, i.e. a microscopic bit of colourless granular jelly-like stuff called *protoplasm*, embedded in which is a rather denser bit called the *nucleus*, the whole being surrounded by a layer of clear protoplasm. This protoplasm has the properties which we associate with *life*—i.e. it is the living part

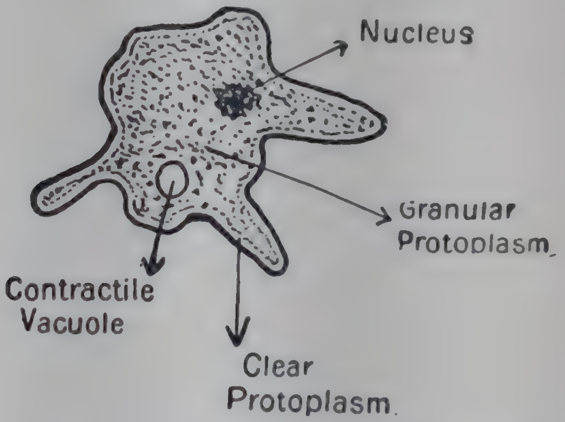

Fig. 1. Amœba (much magnified)

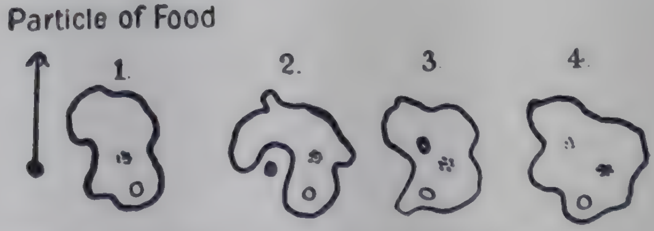

Fig. 2. Amœba taking in and digesting food
In 4 the food has nearly disappeared

of every plant and animal. Huxley called it "the physical basis of life." Its shape is irregular and variable, because the protoplasm keeps on pushing out little arms or projections, which creep round any tiny particles of vegetable matter which may float within reach and incorporate them, by digesting them, so that though at first the particles can be seen enclosed in the protoplasm, they soon disappear. There is no mouth. The amœba *breathes* and *excretes waste* by means of a space in its protoplasm which it can fill with water and empty again, by shrinking it up and so squeezing out the water. From the water taken, it abstracts the dissolved oxygen and mineral salts and into it passes the waste formed from food, respiration, etc. This water, charged with refuse, is now squirted out, and the process begins again. Further, the amœba *reproduces* by the simplest of all processes, i.e. cell-division. Division begins in the nucleus, and then the rest of the protoplasm divides, grouping itself round the

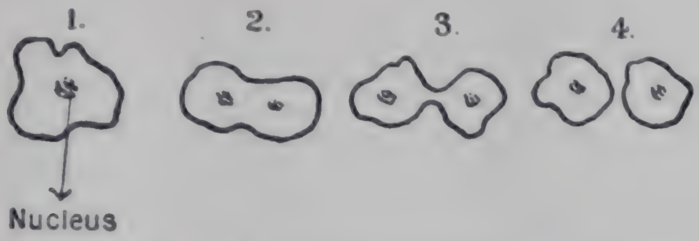

Fig. 3. Reproduction in the amœba

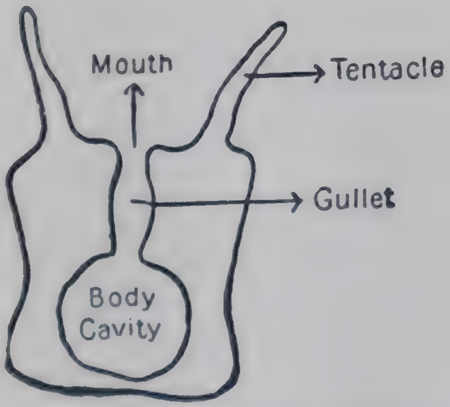

Fig. 4. Diagrammatic section through sea-anemone

two daughter-nuclei and eventually entirely separating. Each of the new cells goes through the same stages, and so one amœba may, in a day or two, give rise to hundreds of thousands ; i.e. the amœba performs *all the fundamental life-processes*—it feeds, excretes, reproduces.

As one ascends in the animal kingdom one finds animals consisting of more than one cell, and soon, *division of labour* is found, i.e. not every cell performs every vital function, but certain cells take on special work. For instance, *a sea-anemone* is multicellular, the cells forming two layers, and it possesses a gullet which is marked off from the general body-cavity. Further, certain cells in the inside layer bring about reproduction. Others, on the outside, sting. Higher in the scale, we find ever-increasing differentiation, till we reach the maximum complexity in *Man*.

Certain terms used in describing the structure of the body may be defined here :

Tissue. This word is used for a collection of cells of one sort,—e.g. fat is a tissue built of fat-cells ; bone is a tissue built of bone-cells ; muscle is a tissue built of muscle-cells ; and so on. These tissues are grouped into *Organs* and *Systems*, each with a definite function, the chief systems being :

1. **The Skeleton,** consisting of bones, fastened together by ligaments, formed of white fibrous material called *connective tissue.* The function of this system is to support the body.

2. **The Muscular System,** or flesh, whose function is to produce movement.

3. **The Respiratory System,** consisting of air-passages and lungs,—whose function is the absorption of oxygen and the elimination of waste, in the form of carbon dioxide and water.

4. **The Circulatory System,** consisting of heart and blood-vessels,—whose function is to carry food and oxygen to all tissues, carry waste to places where it can be got rid of, destroy germs which get into the body, and distribute heat.

5. **The Digestive System,** consisting of the mouth and its salivary glands, the gullet, the stomach and its glands, the intestines, liver and pancreas. Their work is the digestion of

food, i.e. tne alteration of it till it is absorbable through the walls of the blood-vessels.

6. **The Lymphatic System,** consisting of vessels and glands which help in the nutrition of the tissues, the removal of their waste and the manufacture of one of the constituents of blood (white corpuscles).

7. **The Excretory System,** consisting of skin, kidneys and lungs,—whose work is to get rid of waste.

8. **The Nervous System,** consisting of brain, spinal cord and nerves,—whose work is the control of all the organs and functions of the body, mental and physical. The Nervous System supplies the central governing power by which the activities of all the systems and organs of the body are brought into harmony, so that they act for the welfare of the whole.

The Child compared with the Adult. *The* thing that one needs to bear in mind with regard to the child is that all its body-tissues and systems are *immature*, and that some of them remain so for years ; e.g. the Nervous System probably does not reach its full development till somewhere about the age of forty. Now all young immature things are delicate and very plastic, i.e. easily influenced for good or bad by external factors, and they therefore need more careful treatment than do adults. Wrong treatment (as does right) produces lifelong effects on body, mind and character.

Factors influencing Development of Child. These may be considered under two heads: (1) Factors due to *Heredity*: (2) Factors due to *Environment.* Anything like a full discussion of these two sets of factors is impossible here, but no thoughtful teacher can fail to realise that both exist, and that both affect tremendously the children under his or her care.

Until recently, all social and philanthropic work aiming at bettering the condition of the world has been confined to an attempt to better the environment, e.g. to provide higher wages, better food, clothes, air, houses and such-like, and very desirable these things usually are, but the question remains as to whether philanthropy has not been one-sided and narrow and lacking in courage, in ignoring the other great fact,—that of *heredity*,—or at least, in assuming that it is beyond the scope of practical possibilities to alter or affect it in any way.

Before one can express an opinion worth having on such a subject, however, one needs to enquire into the facts of heredity :—What is its strength ? For how much of a man is it responsible ? Which is relatively the stronger influence in forming a Man,—heredity or environment ? Is heredity really a thing quite beyond control ? Thinking people are, to-day, gradually coming to the opinion that we have underestimated the strength of the heredity factor in moulding men and women, and that we have overestimated its uncontrollability.

There is one science, of comparatively recent birth, which has made investigation of this matter of heredity and environment its special province,—and that is the science of *Eugenics*, which is defined as "the study of agencies under social control, that may improve or impair the racial qualities of future generations, either physically or mentally." The word "*eugenic*," derived from the Greek *eugenes* meaning good in stock or hereditarily endowed with noble qualities, was invented by Sir Francis Galton, who founded a laboratory for the study of National Eugenics in the University of London. That laboratory is under the supervision of Prof. Karl Pearson, and it has issued a series of very interesting *Memoirs*, *Lectures* (1s. each), and *Questions of the Day and of the Fray* (1s. each). It is impossible to mention all the books dealing with this science, but the following can be recommended to anyone wishing to go further into the matter : *Essays in Eugenics*, by Sir F. Galton, and a series of pamphlets published by the Eugenics Education Society, Kingsway House, Kingsway, W.C., on Eugenic Education in School, through the Church, etc.,—costing 3d. each. *The Problem of Race Regeneration*, by Havelock Ellis (6d.), published by Cassells, and one of a series called *Tracts for the Times*, promoted by the National Council of Public Morals. *Eugenics*, by Schuster. *The Progress of Eugenics*, by Saleeby (5s., Cassell).

The trend of modern Hygiene is, at any rate, in the direction of beginning to look after the environment of the individual from the very beginning of its existence. A few years ago it was supposed to suffice if we began with the child when it entered school, whereas now on all hands we hear of Schools for Mothers, Infant Clinics, Maternity Centres, and so on, i.e. we are urged to look after the child as soon as it is born, and even before,—and the result has been a greatly decreased infant mortality. Many investigations have shown that the state of the child at birth is greatly affected by the conditions under which the mother has lived during the previous months, e.g. whether she has had sufficient rest from work, etc.

Here, I should like to give Mr. Havelock Ellis's summing up of the social reform of the last hundred years.

It has proceeded in four stages:

1. The effort to clear away the gross filth of our cities, to improve dwellings, to introduce sanitation, and to combat disease.

2. The attempt to attack the problem more thoroughly by regulating the conditions of work and introducing the elaborate system of factory legislation.

3. The still more fundamental step of taking in hand the children who have not yet reached the age for work, nationalising education, and ultimately pushing back the care and oversight of infants even to the moment of birth.

4. Finally, most fundamental step of all, the effort which is still only beginning, to provide the conditions of healthy life even before birth.

He adds that " We must realise, at the same time, that this movement has been exclusively concerned, not with the improvement of the quality of human life, but exclusively with the betterment of the conditions under which life is lived. It tacitly assumed that we have no control over nor responsibility for its production. It accepted human life—however enormous it might be in quantities, however defective in quality—as a God-given fact which it would be impious to question. It heroically set itself to the endless task of cleansing the channels down which this muddy torrent swept. It never went to the source."

Now, it is, of course, very important that the conditions of life should be right,—and it always will be. The mistake has been in concentrating attention on the soil and ignoring the seed, or, as I suggested before, in the lop-sidedness of our social work. We don't want to relax our efforts at improving environment,—but we want to include also the care of the seed. As Mr. Ellis remarks, as long as we ignore the seed and concentrate on environment the greater are the burdens we are piling on ourselves, because we are making the way smooth for the fit and thus helping them to become fitter and to pass on their fitness to future generations,—but alas, *in even greater degree*, we are smoothing the path for the unfit, helping them to compete with the fit and encouraging them to propagate their unfitness, where on a rougher road they would succumb *to a greater extent than the fit* and therefore be much less likely to pass on their unfitness to future generations.

The results of our improvement of the conditions of life during the last hundred years have been disappointing, for though it has involved a heavy cost in money and labour, it is doubtful if the quality of our people is any better than it was when they lived under conditions of dirt, intemperance and disease which would not be tolerated for an instant to-day. One test of the success of Social Reform is the *amount of pauperism* existing. It should be decreased, but as a matter of fact it has remained fairly constant during the whole period of social reform, apart from the period of the War.

Another instance of the failure of improvement in environment is derived from study of the *feeble-minded*. In 1908, the *Royal Commission* on the Feeble-minded came to the conclusion that nearly ½% of the population came under this head, exclusive of certified lunatics, and that half of these were unprovided for and a danger to Society, whilst many of the other half were not under the best conditions. Now feeble-mindedness is largely hereditary. It was formerly supposed to be due to drink, starvation, depravity, etc., and a few authorities still think so, but the majority of experts consider that none of these is the fundamental factor in producing feeble-mindedness ; e.g. Dr. Ashby, Medical Officer to Special Schools at Manchester, estimated that 75% feeble-minded children are born with the inherited defect, and later work by Dr. Tredgold gives 82% hereditary, whilst environment accounts for 10%, and alcohol and consumption (or both) account for 7%. Further, it is important to remember, in this connection, that feeble-mindedness is closely associated with *Crime* and *Prostitution* and *Unemployableness*; e.g. 75% of the children in an industrial school were defective, the mental state being probably inborn. Lastly, for more than fifty years there has been reason to think that *insanity is increasing.*

Now, if it be true that hitherto we have been ill-balanced in our attempts to help the world by attending solely to environment, we must try to substitute some better scheme. We cannot go back to the old method of "natural selection" or "sending the weakest to the wall" for two reasons:

1. We are permeated with Christian ideals.

2. Under Natural Selection the *survivors* suffer—being rendered less fit than they might be. What we *can* do is to aim at preventing the production of the unfit. We want the already existing and growing sense of social responsibility to widen its outlook to include those who are coming after us, as well as those already with us. And this is by no means an impossibility, for during the War our men have been fighting very largely to save their children from the possibility of having to go through sufferings such as they have themselves endured. Surely when we realise how many other sufferings and disabilities we may save our children from by intelligent preparation for and guarding of parenthood, we shall not fail them through selfishness. The next question is, How is this to be done? There are various answers because there are various possible lines of work. Indifference and ignorance and prejudice are big difficulties in the way. Parents need to be trained in the facts concerning the beginning of life, and to a grasp of the responsibilities which this knowledge lays on us, and this training should *begin* early, while the future parent is still a child. Of course one can only teach a child a little at a time, and gradually,—but can any parent really think it good to leave such instruction to chance, to be picked up in the gutter, so to speak? At present, mothers are often unfitted to give any teaching on the subject, and then the next best person is the teacher or doctor. As to methods, one cannot attempt to lay down the law, for the matter needs very

serious consideration ; but I feel very strongly that instruction in sex-hygiene should be coupled with the teaching of the Christian ideal of the body,—The Temple of the Holy Ghost. I believe that Knowledge, backed and inspired by the driving force of Christianity, is the combination that will bring about Race-regeneration,—and that we cannot expect one without the other to do it.

It is often said that consideration for the race will never alter the selfishness of humanity,—but some doctors say that it is tending to do so, and there are signs that eugenic considerations will become a factor in the teaching of religion (compare Suggestions as to Marriage in *Papers from Picardy*, by Revs. G. Gordon and Pym). Again marriage-restrictions exist in every race,—e.g. restrictions of caste, class, tribe,—and there is no special hardship in a restriction from marrying into the class of the unhealthy. One wants such a restriction, however, if it is to be of real value, to spring from an educated Public Opinion, and not merely to be imposed by Law. A step in the right direction was taken in 1913, in the " Mental Deficiency Bill," which makes *life-long* care of the mentally deficient possible, this being mainly, of course, with the object of preventing marriage.

CHAPTER II

THE SKELETON

Structure and development of bone—General build—Spinal curvature —Flat-foot—Joints.

THIS consists of the bones and the connective tissue joining them. This connective tissue consists of cells mostly elongated into fibres, with some fluid between the fibres. When it joins bone to bone it is called ligament.

Now, in early life, e.g. in a baby, bone consists largely of *gristle or cartilage*, of which most people know the appearance and characters, from ordinary meal-time experiences. Gristle consists of a smooth, elastic, transparent, blue-white glassy substance, and under the microscope one can see groups of round or oval cells here and there in the glassy matrix. There are no blood-vessels in it. It is, of course, much less brittle and much more flexible than bone, and hence a baby's bones are comparatively soft, i.e. they bend easily, though they

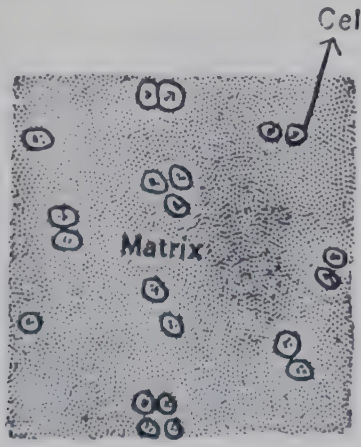

Fig. 5. Section of gristle (magnified)

are less likely to snap than are those of the adult. Hence the special care needed in the matter of *posture* in children, and the characteristic type of *fracture* in children, known as the *Greenstick fracture,* i.e. a sudden strain or blow on a child's bone does not produce a clean definite break, but a bending and splitting, similar to what happens if you try to break off a *green* branch.

The *change* which converts this gristly bone into the ordinary, hard, adult bone is called *ossification,* and begins before birth and continues till twelve or possibly a good deal later (e.g. twenty-five). At any rate, one must consider the child's bones as being *plastic* throughout the greater part of its school-life. The process of ossification is due to blood-vessels growing into the cartilage, from the membrane covering the bone. This causes the gristle-cells to burst, and in their place bone-cells appear, arranged in circles round the blood-vessels, so forming tiny canals through which the blood-vessels run. These bone-cells produce calcium salts which are hard and bony, and thus the gristle gets more and more mineralised, till finally two-thirds of it is mineral and only one-third gristle. Unaltered gristle remains in a few places,—e.g. it forms the framework of the external ear and the end of the nose, and it joins the ends of the ribs to the breast-bone.

Experiment to demonstrate presence of Mineral matter and gristle in bone.

Two rabbit bones:

1. Soaked in acid, which dissolves the mineral, leaving gristle.
2. Burnt—the residue being mineral.

In the bones of the skull the process of development is different, since they are *not* preceded by cartilage, but merely by a membrane which flings out a layer of bone (except in the case of the sphenoid and ethmoid bones).

Structure of a long Bone. If we take any long bone, such as the thigh or arm-bone, we find that it has a long *shaft* and two enlarged *ends*, covered with gristle in life, the shaft being covered with a tough membrane rich in blood-vessels and nerves. On slicing it in half longitudinally, it is found that the shaft is hollow, the bone casing being *compact*, whilst the bone forming the ends is *spongy*, i.e. full of spaces, containing *red marrow*. The hollow in the shaft contains *yellow marrow*. The marrow is supplied with blood by blood-vessels entering through a hole in the shaft. Marrow is of use because it manufactures red and white corpuscles (or blood-cells) for the blood. The blood-vessels in the outside covering membrane pass into the bone, along the canals, and nourish it.

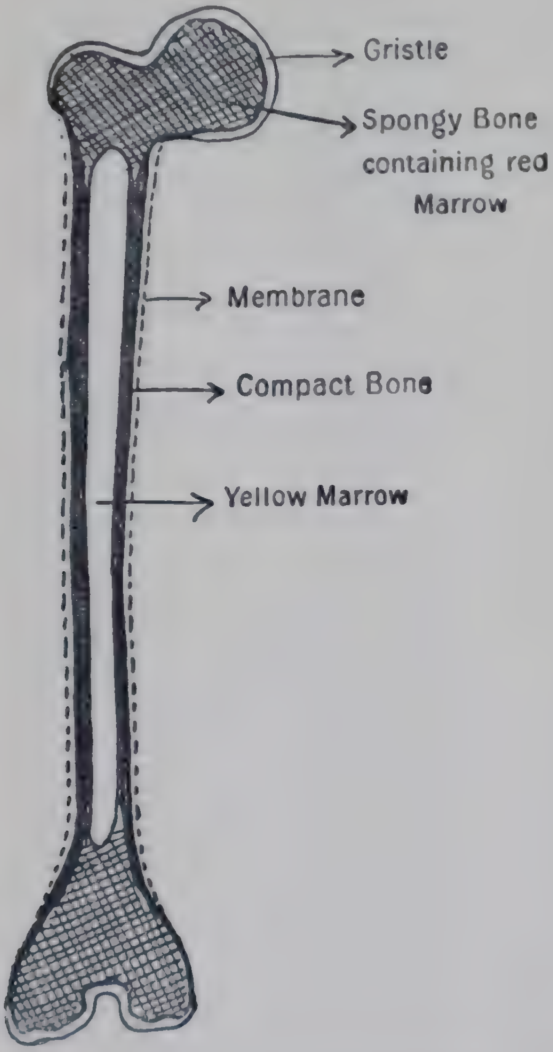
Gristle
Spongy Bone containing red Marrow
Membrane
Compact Bone
Yellow Marrow

Fig. 6. Diagrammatic section of a long bone

The Build of the Skeleton. The mainstay of the whole is the spinal column, consisting of separate bones, called

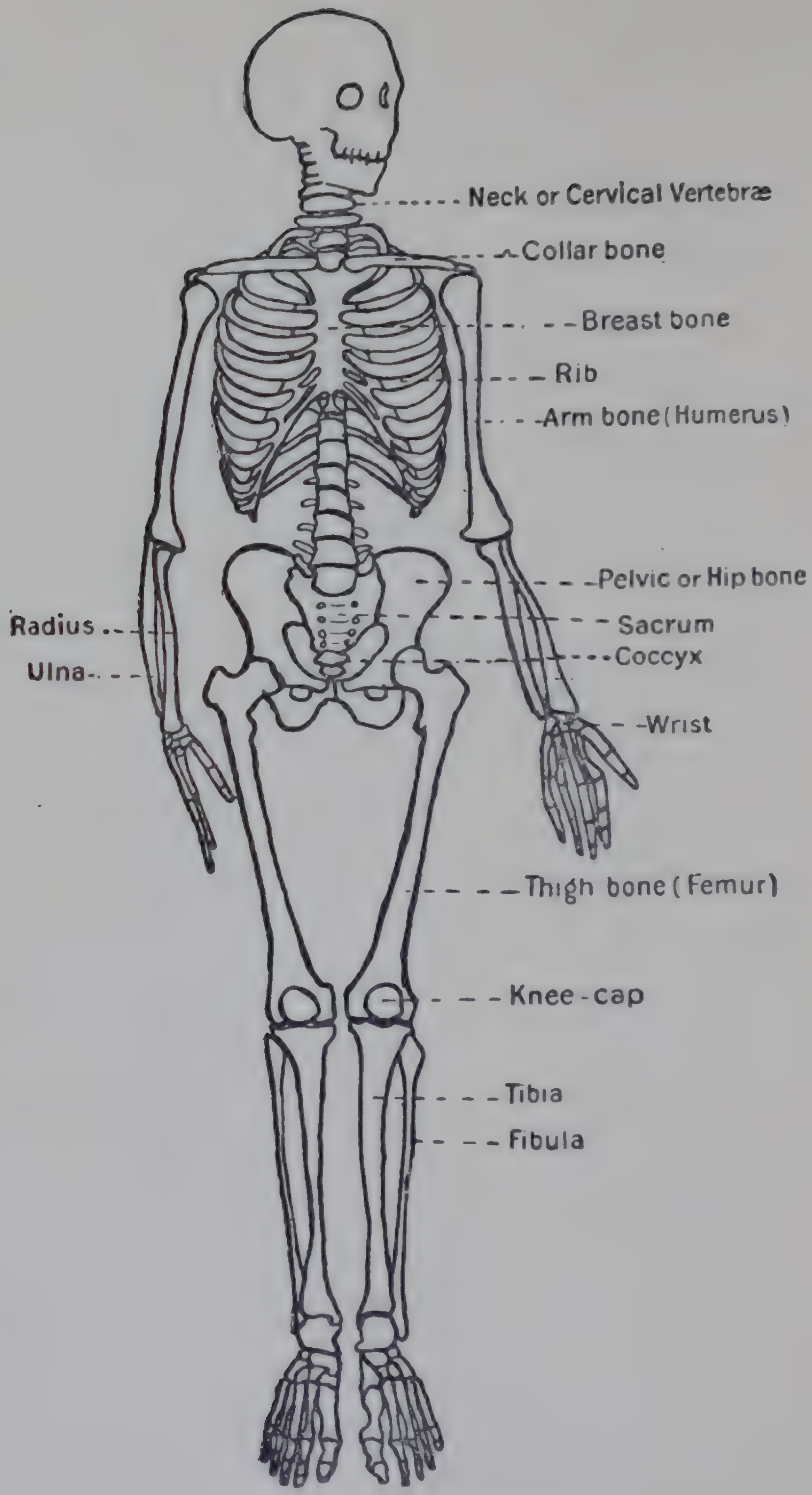
Neck or Cervical Vertebræ
Collar bone
Breast bone
Rib
Arm bone (Humerus)
Pelvic or Hip bone
Radius
Sacrum
Coccyx
Ulna
Wrist
Thigh bone (Femur)
Knee-cap
Tibia
Fibula

Fig. 7 The skeleton

vertebræ, twenty-six in the adult and thirty-three in the baby. The vertebræ get bigger from above downwards, and the top and bottom pairs are specialised, but a typical vertebra from anywhere else in the spine consists of a solid body and three projections, enclosing a cavity. These bones fit one on top of the other, so that the holes form a tube, down which the spinal cord runs from the brain. The two top vertebræ are called the *atlas* and *axis*. The top one, or atlas, supports the head and has no body, but two smooth surfaces which fit against two similar surfaces on the base of

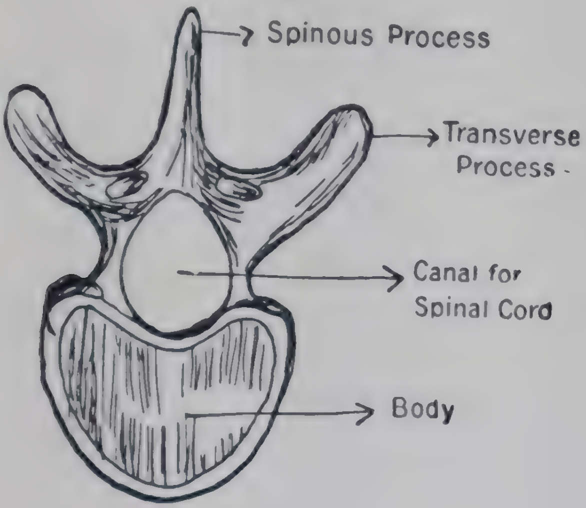

Fig. 8. A vertebra

he skull. The second, or axis, has a peg which sticks up hrough the ring of the atlas and so forms a *pivot joint*, on which the head turns. The two bottom vertebræ, the sacrum and coccyx, form nine separate bones in a baby, but these oin in groups of five and four in the adult. The *sacrum* is a hick, strong bone, roughly triangular in shape, fitting between the two hip-bones. The *coccyx* is a little rudimentary ail.

Each vertebra is separated from its neighbours by pads of gristle, which act as buffers, stopping jars to the brain, and llow of slight rotation and of bending between each pair, he total power of turning and bending being considerble.

The Shape of the Spine as a whole. Looked at from the back the spine should form a straight line; if not, it means lateral curvature.

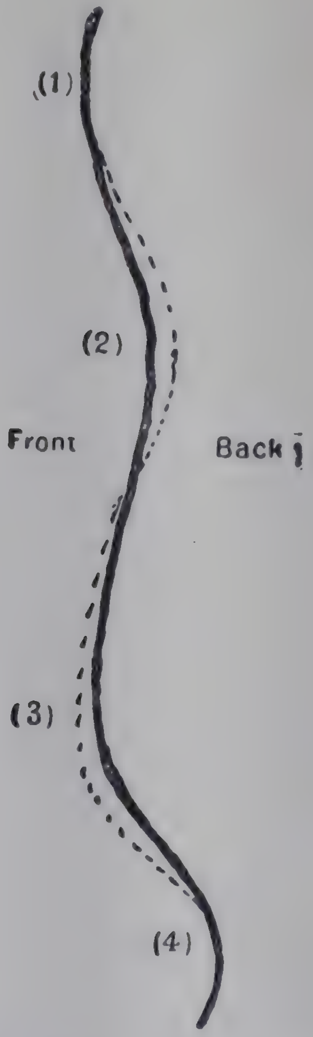

Fig. 9. Curves of the spine (side view)

From the side it has four curves, known as:
1. The Cervical (or neck curve).
2. The Dorsal (or shoulder curve).
3. The Lumbar (or waist curve).
4. The sacrum and coccyx curve.

The use of these curves is to give greater capacity for extension and compression than would be possible if the spine were straight, and so to avoid jars to the brain; e.g. a sudden upward shock to the bottom of the spine would expend itself in accentuating momentarily the curves, as shown by the dotted line in the diagram, and there would be comparatively little movement transmitted to the skull. Further, these curves make the upright posture possible.

Development of the Curves. At birth, only the dorsal curve is present, then as the child raises its head, the neck-curve appears, and as it begins to walk the loin-curve appears.

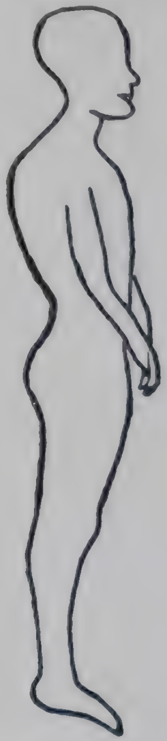

Fig. 10. Round shoulders and hollow back

Excess in the Curves is very common—and bad.

(*a*) *Excessive loin-curve* (hollow-back) is largely due to weakness of the abdominal muscles. Two to four per cent of children show it.

(*b*) *Excessive shoulder-curvature* (round shoulders) is also common and often combined with extra compensatory curvature in the loin-region. It may be due to muscular weakness, or weak will, or short-sight, resulting in habitual wrong attitudes. It is accompanied necessarily by flat-chest, drooping head and prominent abdomen, and if not *due* to short sight, will often help to *produce* it. Hence from the æsthetic and the health points of view, it should be remedied. Suitable exercises and correct posture give good results in early cases, but not in the later stages, though they may hold these stages in check. The reason why curvature is incurable in the later stages is that the cartilage pads between the vertebræ are compressed on the concave side and gradually decrease on this side, as may the bone itself. So we *end* with a structural defect. *Acute* backward curvature (hump-back) is usually due to tubercle of the spine.

(*c*) *Lateral curvature* means usually, in children, a left curvature, giving rise to prominence of the right hip and raising of the right shoulder. It may be due to inequality of the legs, or to bad postures, e.g. standing on one leg, sitting sideways to write, etc. Twenty-five per cent of children show some degree of it, and about one-tenth of these need systematic treatment. Severe lateral curvature is usually to the right in the dorsal and the left in the lumbar region, and needs a long period of rest. It is commonest in girls and often due to rickets. Slight lateral curvature needs right posture and exercises.

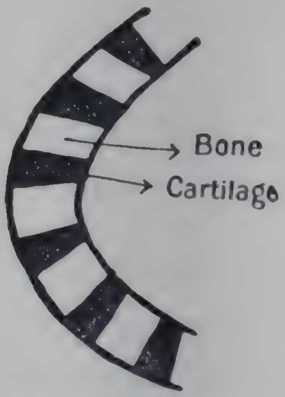

Fig. 11. Diagram showing wedge-shaped cartilages in a curved spine

The Skull consists of two parts : *the cranium*, enclosing the brain and occupying two-thirds of the whole, and *the face*. The cranium consists of eight bones, joined by a special kind of dovetail joint called a *suture*, and the chief point to remember is that in a baby these are not joined, so that the brain may have room to grow ; there are also two gaps, the anterior and posterior fontanelles, which allow of the skull enduring, without cracking, the huge strain put on it at birth. These close at about two years old. Hence the need of great care to prevent knocks or falls on the head, as the result may be brain injury.

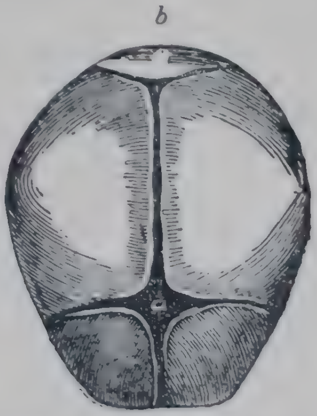

Fig. 12. Baby's skull at birth from above
a. Anterior fontanelle
b. Posterior fontanelle
(From *The Baby*. E. A. Saunders. Methuen)

The Trunk is divided into an upper and lower part: the upper is the chest, or thorax ; the lower is the abdomen.

1. *The Chest framework* consists of the upper part of the pine, behind ; the breast-bone in front, and the ribs (twelve pairs) joining the two. The last two pairs do *not* join the breast-bone and are therefore termed '*floating*.'

The ribs are connected by muscles, running somewhat lantingly, and by these the ribs are raised or lowered during breathing.

It is worth noting that the ribs widen as they descend, and herefore tight-lacing (mercifully now unfashionable) was ound to distort them and so squeeze lungs and heart, the wo great organs occupying the chest cavity.

Round the top of the thorax lies the *shoulder-girdle*, consting of the two triangular shoulder-blades behind and the wo collar-bones in front. The shoulder-blade is united by a oint at the shoulder to the collar-bone and to the arm-bone.

The other end of the collar-bone is jointed to the breast-bone. (See diagram of skeleton.)

2. The abdominal framework is called the *pelvis* or *pelvic girdle,* and is formed of the sacrum and coccyx behind, to which join the two great hip-bones, which unite in front. The rounded head of the thigh-bone fits into a cup-like hollow in the hip-bone, so forming a ball-and-socket joint.

The Limbs. *The arm* has one long bone reaching from shoulder to elbow (humerus); two from elbow to wrist (radius and ulna). The wrist is formed of eight small, roughly cubical bones. The hand has five bones (metacarpals) in the palm and three (phalanges) in each finger except the thumb, which has two.

The leg has one long bone (the femur) reaching from hip to knee, and two from knee to ankle (tibia, fibula). The ankle has seven bones, of which one is much the biggest and forms the heel. The foot has five (metatarsal) bones embedded in the solid part and three in each toe except the great toe, which has two (phalanges).

Bone Disease. The two chief diseases of bone are Rickets, which is discussed in Chapter VII, and Tubercle, which is described in Chapter XVIII.

Flat-foot. This is a common deformity, as is illustrated by Dr. Kerr's statement that before the War it caused the rejection of one-third of the recruits in some European armies. About one-third of the children in the poorer schools have some degree of flat-foot.

The condition is aggravated by much heavy work out of school, and by heavy, stiff boots and clogs, especially in the case of weakly, ill-fed children.

The immediate cause is the stretching of the ligaments supporting the arch of the foot, so that the whole sole touches the ground instead of only the heel, toes and outer side of the foot. The result is pain and a clumsy gait. The treatment consists in heel-raising exercises, walking on tip-toe, dancing and skipping. Older people may need supports in the shoes.

Joints. These are places where bones join. They may be *fixed* or *movable.* Examples of fixed joints are seen in the sutures of the skull. Examples of movable joints are seen in the *pivot-joint* between axis and atlas, the *hinge-joint* at the elbow; the *ball-and-socket joints* at shoulder and hip.

The structure of the ordinary movable joint is shown diagrammatically in the accompanying sketch. The ends of the two bones are enclosed in a bag of connective tissue called the capsular ligament and lined with cells which pour out a sticky lubricating fluid (synovial fluid). This, together with the gristle covering the ends of bones, enables the bones to move over one another without grating. Sometimes when joints crack and grate on bending, it is due to drying up of the fluid.

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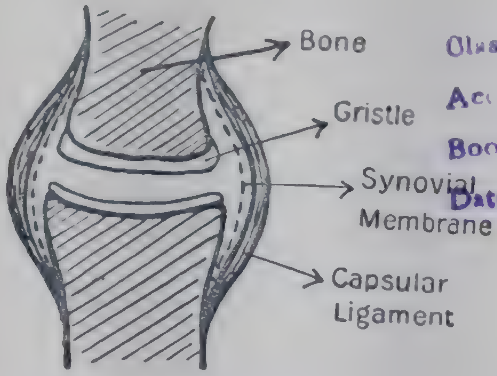

Fig. 13. Diagrammatic section through a joint

Conditions of Joints for which the Teacher should be on the look-out. Pain, if chronic, usually means tubercle, or rheumatism. It is often described as "growing-pains,"—a bad misnomer, since healthy growth is painless,—and is usually accompanied by stiffness. The hip and knee are most commonly affected, and so the child limps and stands on one leg.

Treatment. The child should be sent away from school, and given rest, food and fresh air. The limb should be in splints if tuberculous. Rheumatism is serious because of its effect on the heart.

CHAPTER III

THE MUSCULAR SYSTEM

Structure of muscle—Relation to bones—Movement—Growth—Physical exercise (games, dancing, swimming, formal)—Posture—Muscular fatigue—Place of manual work.

MOST of the flesh consists of muscles.

A muscle consists of microscopic fibres arranged in bundles, a great many of these bundles existing in every muscle. Usually at each end the fibres pass into tough connective tissue which joins different bones. Connective tissue of this sort, joining muscle to bone, is called a *tendon*. If the muscle passes over a joint, its tendons join different bones, and the points of junction of tendon and bone are respectively called the *origin* and *insertion* of the muscle. Each fibre contains liquid,—which is the reason why meat is juicy,—and it can change its shape from being long and thin to being short and fat, and vice versa. Also, it is sometimes marked with alternate dark and light lines, running transversely. Such a muscle is said to be *striated*, or striped ; others lack striations and are therefore called *unstriated*. Amongst the fibres lie nerves, blood-vessels and connective tissue.

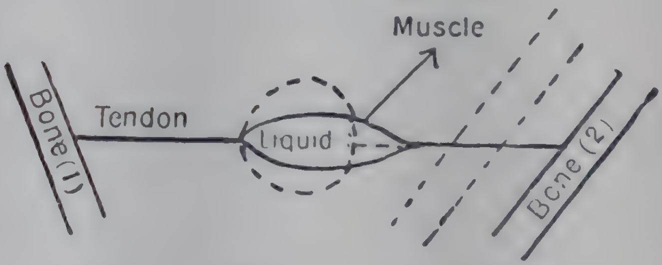

Fig. 14. Diagram of muscle-fibre

Dotted lines show fibre contracted, and the consequent pulling of bone (2) nearer to bone (1)

The Work of Muscles is to produce movement. When the brain decides that some part of the body shall move, it sends nervous energy along the nerve leading to the muscles concerned, and this stimulates the fibres to contract—i.e. get shorter and fatter. The energy needed for muscular contraction is derived from chemical changes in the muscle,—partly oxidation and partly decomposition,—which give rise to waste products, of which the simplest is carbon dioxide.

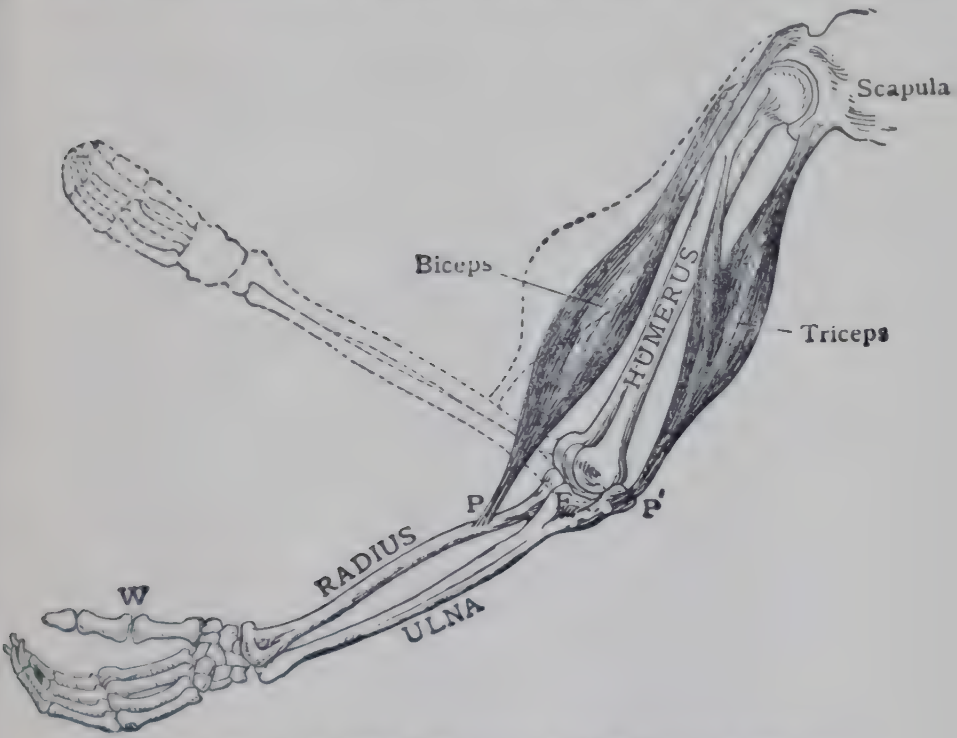

Fig. 15. To show the action of the biceps muscle in bending the forearm

(From Thornton's *Elementary Physiology*. Longmans, Green and Co.)

These are removed by the blood as it flows through the excretory organs. A further effect of the chemical changes occurring in a muscle when it contracts is heat-production. This heat is distributed over the body by the blood-stream, so keeping the temperature constant ; e.g. the temperature of a beehive may be 20° higher when the bees are excited and angry than when they are quiet. If a muscle contract, movement is bound to occur at the joint over which that muscle passes , e.g. the action of the biceps muscle, forming the fleshy part of the front of the arm, brings about the raising of the forearm. The biceps is so called because it has *two* origins on the shoulder-blade. It is inserted into the radius. When it contracts, the forearm is pulled up, the bending occurring at the elbow. When it relaxes, and therefore lengthens, the forearm falls back, and the return is helped by contraction of the triceps, forming the flesh at the back of the arm.

Involuntary Muscles. These act independently of the conscious part of the brain. They form the walls of the internal organs, such as the heart and stomach. One knows from experience that the heart beats and the stomach-walls móve and churn up the food independently of our wills. Hence the name. These involuntary muscles have no striations or tendons.

Growth of Muscle is due to division of the fibres longitudinally,—thus producing new fibres. This division is encouraged by a good supply of healthy blood, carrying food to the muscle. This involves (1) exercise ; (2) pure blood. One knows from experience the muscular effect of a sedentary life, or of disuse due to illness, viz. flabby flesh, of poor " tone." Further, insufficient or wrong food affects the quality of the blood, and hence the food-supply to the muscle. So does lack of fresh air. (3) In addition to (1) and (2), a muscle needs rest after exercise, to allow the blood time to remove the waste-products formed by the chemical changes in the muscle. These products cause the sensation of fatigue and are removed from the blood by the excretory organs : skin, kidneys and lungs.

Physical Exercises. At this point we may well consider the question of physical exercises and especially with regard to school children. It has been realised for some time that brain and body are so interdependent that no true education could ignore body-training, and also that the conditions of school-life are unnatural and cramping. Hence the introduction of games and physical exercises into school-life. The old proverb about " A healthy mind in a healthy body " is a statement of fact for the generality of humanity, though here and there one may light on exceptions.

The Benefits of Organised Games[1] are probably familiar to you ; they are at least as much mental and moral as physical.

(*a*) The physical effects include quickened heart-beat and blood-flow, and therefore greater food-supply to the muscles, and quicker removal of waste. Breathing, excretion, digestion, all go on faster, therefore appetite increases and there is less liability to chest ailments and indigestion. Dr. Kerr thinks the best way to develop both respiration and circulation is to have frequent periods of play for young children. Strength increases, fatigue decreases. Finally, the nervous system is stimulated.

(*b*) The mental and moral effect is to develop quickness of decision, coolness, judgment, esprit de corps, subjugation of individual interests to those of the community (side or eleven), self-control in victory *and* defeat, public-spirit,—and to give enjoyment and pleasure.

Hitherto the provision for organised games in the Elementary School has been as scanty as that in the large Public Schools has been generous, but an increasing number of Education Authorities are now making provision for such games, and the tendency is admirable : e.g. (1) *Manchester* has a good scheme, in which the parks are utilised. Only Standards four to seven can share in these games, but it is hoped that gradually all the schools will have facilities for them. The Superintendent of Physical Exercise has arranged classes to coach teachers in games (excluding cricket and football). (2) *Birmingham* has three playing fields and excellent arrangements for games on summer evenings in parks, etc., for working lads and girls as well as for school children.

It has been suggested that further facilities for games might be provided by Local Education Authorities by :

1. Full or extended use of schools, playgrounds, etc., out of school-hours and during holidays.

2. Provision and equipment of recreation grounds and open spaces.

3. Employment of skilled supervisors for evening and outdoor recreation.

4. Co-operation with voluntary associations.

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[1] For the special value of dancing and swimming, see Board's new Syllabus of Physical Exercise.

Girls and women usually lack exercise more than boys or men ; and it is wise to teach girls the effects—including superfluous fat, blotchy skin, poor blood, clumsiness, constipation, etc.

Formal Physical Exercises have all the above-mentioned physical effects, if properly conducted, though they are not of such moral value. In addition, they are so adjusted as to exercise *all* parts of the body, and one cannot rely on most games to do this. Their object is to help in the production of a well-balanced and harmoniously developed body and mind, *not* to produce an athlete. Their effects are classified in the Board of Education Syllabus of Physical Exercises, thus :

Effects of Physical Exercise

PHYSICAL			EDUCATIONAL
Nutritive	*Corrective* for defects and mal-postures.	*Developmental* (or control)	e.g. discipline, order, quick and cheerful response to orders, endurance, self-restraint, co-operation.

A fuller discussion and explanation of these effects is given in the Syllabus, and it should be read in connection with this chapter.

General Rules for Physical Exercise

1. Since it is much more tiring physically and mentally than play, most people agree that formal physical exercise is not fit for young children. Some authorities consider eight to nine the best age at which to begin, and though the Board of Education says that some preliminary instruction can be given from five to seven, it points out that lessons must be short (not more than fifteen minutes) with plenty of stop for rest ; commands must be in the ordinary speaking voice, and no precision of movement must be demanded.

2. Lessons should be *frequent*, short and daily giving better results than long and bi-weekly, say. The time usually

given to the subject is one hour a week, and this is best divided into three periods of twenty minutes, because it enables a complete table to be taught three times a week. It cannot be done in less, and if one group of exercises is omitted the lesson loses its balance and completeness and cannot be regarded as satisfactory.

In some schools four or five lessons a week are given, e.g. Shropshire Education Committee recommends fifteen to twenty minutes daily. In this case two lessons can be given to more recreative work, such as games, dancing or swimming.

3. Both lessons in physical exercises and games should be *regular*, irregular exercises often doing more harm than good, because the muscles, being out of condition, are strained by the sudden call on them, and this may injure the heart.

4. Lessons must be *graduated*, to suit age.

5. Lessons must not involve over-fatigue or overstrain or risk of heart-trouble.

A certain number of children in school are unfit to go through a complete lesson in physical exercise. These include a good many rapidly growing or overgrown children, especially girls between the ages of thirteen and sixteen. Dr. Warner estimated that seven per cent of girls between these ages should be entirely excused from the lessons. Further, rheumatic children are likely to fall into this category, because rheumatism is so often accompanied by heart-weakness, and one should remember that "growing-pains" usually mean rheumatism and that for practical purposes St. Vitus' Dance is a form of rheumatism (viz. of the brain). Again, children who are "run-down" and debilitated after an attack of illness, such as measles or diphtheria, and any suffering from heart-disease, should have less strenuous exercise than the normal child. One should immediately pick out children who get cold, pale or breathless towards the end of a lesson.

6. Lessons must be *varied*, to avoid monotony.

7. Lessons must be in the open air, if possible—if not with all doors and windows open.

8. Common mistakes must be stopped, e.g. holding breath, contracting or unduly expanding chest.

9. Suitable clothes *should* be worn: at any rate tight belts and collars can be undone, and it is possible to make shoes in school, from felt, list, etc. These can be worn for drill, and incidentally the changing gives the teacher a chance to see stockings that badly need mending and to urge that this be done. This has actually been done in a London school which was famous for its dirtiness and general unpleasantness, by a head mistress who determined to reform matters, and she succeeded extraordinarily.

10. Consult the doctor about doubtful cases, e.g. spinal curvature, marked shortness of breath, heart cases.

Posture. One wants common sense here. There is no need to worry children over trifles, but really bad postures may produce serious results and therefore must be corrected. Of course, hygienic desks and time-table are needed; without them one cannot avoid wrong postures. *The children who specially need watching* in class are the pale, flabby individuals, especially girls from twelve to fourteen years old. *The lessons*

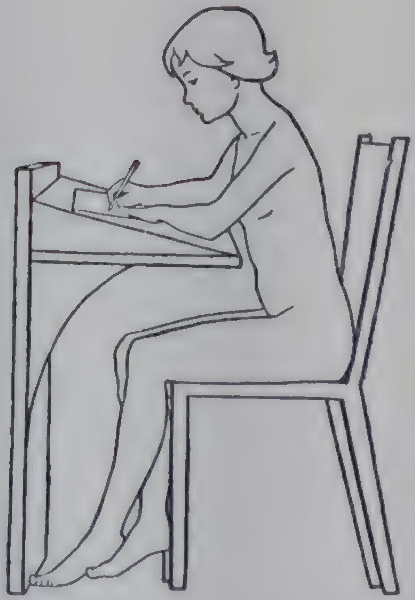

Fig. 16. Good position: Writing

Essential points: Whole of thigh supported. Base of spine against back of chair. Chair close enough to desk. Eyes at correct distance from work.

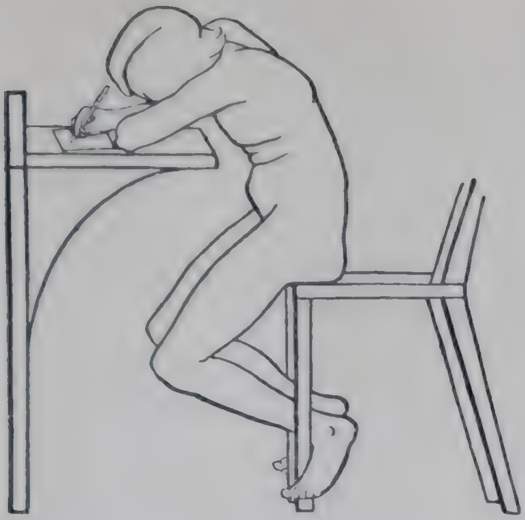

Fig. 17. Bad position: Writing

Essential points: Thighs and spine unsupported. Chest and lungs cramped. Shoulders lifted. Chair too far from desk.

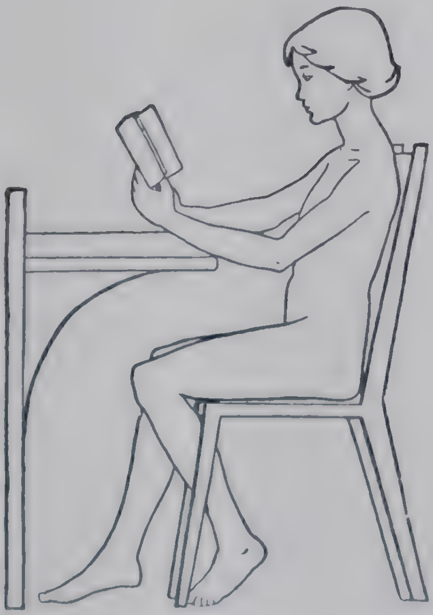

Fig. 18. Good position: Reading

Essential points: Whole length of thighs, spine, and arms supported. Eyes at correct distance from work.

which specially need watching are reading, writing, sewing and drawing.

Good posture is one in which the body is so balanced as to produce least fatigue. In sitting, this means that the child should sit squarely, i.e. with shoulders and hips level, head and spine in line, and he should be able to sweep the forearm over the desk without raising the shoulder when the elbow is bent at right angles and touching the side of the body. The correct distance between eyes and work is one foot.

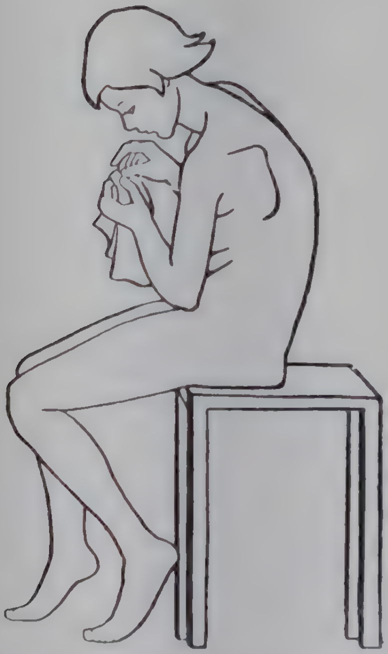

Fig. 19. Bad position: Sewing

Essential points: Thighs, feet, and spine insufficiently supported. Spine bent, ribs cramped in front, shoulders not level.

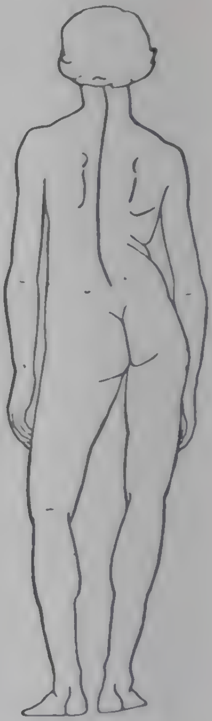

Fig. 20. Bad position: Standing "on one leg," i.e. with one knee bent

Essential points: Curvature of spine. Tilting of shoulders and hips.

Figs. 16 to 20 by permission of the Ling Association. The full set of 10 diagrams can be obtained from Messrs. Spencer, Heath and George, Ltd., 54 Goswell Road, London, E.C. 1.

Size, 15″ × 20″, on card; price, 5s. post free.

Bad posture is commonest in writing, where the child often sits with one arm on the desk and the other off it, and with the head close to the paper. The results are headache,

ort sight, spinal curvature, flat chest, and therefore a
ndency to chest-troubles and a general decrease of vitality.
ertical writing is least conducive to wrong postures, and
ere is no reason why the paper should not slant slightly.

Muscular Fatigue and Overwork

Definition and cause of fatigue (largely from the Report of
e Health of Munition Workers Committee on Industrial
fficiency and Fatigue).

“ Fatigue is the sum of the results of activity which show
emselves in a diminished capacity for doing work.”

The Report proceeds to point out that we usually estimate
tigue by our sensations of tiredness, and that it is absolutely
ecessary to realise that these sensations are a most untrust-
orthy index. We are often quite unconscious of fatigue in
s earliest stages, and the only reliable way of measuring it,
any stage of its progress, is by the reduction in capacity
r work which it produces.

The performance of work depends on the activities of three
rts of the body : (1) *brain and spinal cord*, which are con-
rned in the initiation and distribution of impulses to action.
) *The nerves*, which conduct the impulses to muscles.
) *The muscles* themselves, which by contracting finally
rform external work. Fatigue has been separately studied
all these parts, and in all it has been found that fatigue
pends not on the simple using up of the substances supplying
e chemical energy liberated during work, but on the accumu-
tion in these parts of the products (toxins) of these chemical
anges. Fatigue, this is to say, is *not* to be compared with
failure of fuel in a steam-engine or with the running-down
a clock-weight, but rather with the clogging of the wheels
a machine by dirt. These products of activity of nerve
muscle-cells are removed by the blood. Rest after work
not a passive state, therefore, but is itself an active process,
ding to restoration of the normal capacity for work, and
requires time, in proportion to the amount of restoration
ded. If the activity is repeated too quickly to give time
ugh for restoration after each action, fatigue will become
gressively more and more, until further action is impossible.

Of the three groups of organs mentioned above, fatigue practically does not occur in the nerves, probably being unrecognisable owing to their quick recovery and the very small changes in them. Of the other two groups, the brain and cord centres are more quickly fatigued than the muscles, and the important result follows that the brain cannot bring the muscles far towards complete fatigue before it is itself fatigued and powerless. In a tired man the symptoms of fatigue are referred to the muscles; they ache or seem "to give way under him," but really the most severe bodily work fails to produce any close approach to complete muscular fatigue. *The fatigue is fatigue of the Nervous System*, though in sensation its effects may be referred to the muscles themselves. The problems of fatigue are therefore primarily and almost wholly problems of fatigue in the Nervous System and of its direct and indirect effects.

Rhythm of Action and Rest. By this we mean the exact length of work and rest which just allows of recovery after each act, and which will therefore allow the action to be performed over long periods without accumulation of fatigue. It is found that there is a natural rhythm for every action, e.g. heart-beat, breathing, etc., but this natural pace can be altered by training and use; e.g. for work in which severe muscular effort is needed, the maximum output and the best conditions for the worker's comfort and health are attained by short spells broken by longer rests, and this point has practical bearing on many industries; e.g. two officers at the Front recently competed in making equal lengths of trench with equal numbers of men. One let the men work as they chose, but as hard as possible. The other divided them into three sets to work in rotation for five minutes and rest ten minutes, and won easily.

The Committee states that hours of work should vary according to the character of the work. This fact is not realised by many managers, and the tendency is to uniform hours for all kinds of work, and for both sexes. Data collected show that women are unfit for the heavier kinds of work, and even on moderate and light jobs they can't stand such long hours as men. It is obvious that if we impose rhythms of work nd rest which are faster than the natural ones, we get accu-nulated fatigue and therefore diminished capacity for work.

Symptoms of Fatigue. 1. The essential symptom, as tated above, is reduced capacity to do the act that caused he fatigue, but (2) there is evidence to show that accumulated atigue in connection with a given act may affect adversely he condition of other parts of the Nervous System, not irectly employed ; e.g. it has been shown that immediately fter a gymnastic lesson intellectual work is not as good as efore, and the backwardness of many "half-timers" is robably due to muscular fatigue, to a certain extent. It s doubtful, however, if these associated or indirect results rovide a trustworthy index of the primary fatigue : they ive indications, but irregularly in some cases, and not at all n others, that the general "tone" of the Nervous System is owered after a day's work and also declines during a week's ork.

3. An important and early sign of fatigue is a want of o-ordination and failure in power of concentration, shown in he increased frequency of trifling accidents, due to momen-ary loss of attention. These may result in the breaking of ools, spoiling of work, etc.

4. The accumulated results of fatigue are damaging to eneral health and "spirits," and in factories, for example, this hows clearly in returns for sickness and lost time. A common ymptom of accumulated industrial fatigue is its effect on he "spirits" of the sufferer, who feels stale, done-up, in-ifferent, lethargic—and at the same time craves for change nd excitement, a craving which probably often leads to lcoholic and other forms of intemperance. This, during the ar, was a common state of affairs in many munition works, nd experienced managers and doctors attributed it almost ntirely to long hours and absence of the Sunday rest. A ingle day off, given occasionally, would probably have voided much waste of capacity and reduction of output. ne foreman says that Sunday work gives "six days' out-ut for seven days' work on eight days' pay." In one factory n the Midlands where there was much Sunday work in the pring of 1916, twenty-two per cent of men were sick at

one time; but in August when Sunday work had been much reduced, only four per cent were ill. This huge reduction in illness was partly due to change of season, but figures from a neighbouring factory showed that the spring was not abnormally unhealthy, and probably the cutting-down of Sunday work was the chief factor.

5. *Feelings*—of tiredness, lassitude.

6. Subsidiary symptoms may be shown by certain of the facial muscles, e.g. by irregular action of the frontalis muscle which raises the eyebrows, and of the corrugator muscle which contracts the brows, so producing horizontal and vertical furrows, and of the orbicular muscles round eyes and mouth. Of these, the orbicular eye-muscles are affected first, giving baggy, puffy eyelids.

An interesting point brought out by the Committee on Health of Munition Workers is the un-wisdom of work before breakfast. Before a meal output is less than after, and also much "lost-time" (i.e. absence from work) occurs before breakfast.

Overstrain. This is the result of fatigue which has advanced to the stage of exhaustion, and it not only reduces capacity for the moment, but does more permanent damage, affecting capacity for periods far beyond the next normal period of rest. It is very uneconomical to allow this damage, and therefore work should stop when the first signs show themselves, for just long enough for recuperation. Remember here that the *feelings* are very untrustworthy guides. Quality and quantity of work is the best test.

Treatment of Fatigue:

1. A hot bath, followed by a brisk rub-down, is good because it causes a flow of blood to the skin, and therefore more excretion of toxin from the skin.

2. *Change of Work.* When fatigue is local only, change of work will rest the tired part; hence it is good to mix physical and different kinds of mental work, so as to use different brain-centres. Nevertheless, as long as *any* work is being done, *general* fatigue is increasing and *sleep* is the only way to relieve this. (See Chapter XI.)

Place of Manual Work. We may consider this in connection with the whole question of exercise. Originally handwork was introduced into the schools from a purely utilitarian motive, i.e. children were taught needlework, cookery, woodwork, etc., in order to train dexterity in home-occupations or trades. Later it was noticed that children who were taught handwork improved in general mentality, the Industrial, Reformatory and Defective Schools being pioneers in this discovery, i.e. the close connection between hand and brain was realised. This, of course, results from the facts, already explained, that muscles are in direct communication with brain-centres, via nerves, that brain-centres are connected with one another, and that therefore muscular work inevitably means brainwork, and may strengthen centres other than those governing hand and eye. Hence handwork is further justified on the score that it is brain-culture. The little child has a natural tendency to bodily activity and to constant practical experiment with his hands, and if we do not give him outlets for this natural instinct we deprive him of a primary necessity for mental development. This fact is recognised increasingly, especially in our Infant Schools. Apart from its mental value, handwork gives valuable relief from the more fixed and unnatural positions necessitated by many of the other subjects in the curriculum.

Choice of handwork. One must remember, here, that the child's brain-centres are very immature and are rapidly developing, but not all simultaneously. The centres governing large, coarse movements mature before those for small, fine movements. Hence the child kicks and stretches and waves its arms about long before it can draw or sew, and the moral is that we must choose handwork according to the child's age, for if we " force " centres to a premature development we not only get poor work, but we run the risk of damaging the whole Nervous System.

CHAPTER IV

THE CIRCULATORY SYSTEM

Blood—Heart and blood-vessels—Circulation—Symptoms of abnormality in blood or heart-action—Lymphatic system.

THIS consists of the heart, blood-vessels and the blood in them.

Blood looks red to the naked eye, but under the microscope is a yellowish fluid containing two kinds of tiny corpuscles: (*a*) yellow ones (red in the mass) shaped like discs with thick edges, about 5×10^6 per drop. These contain hæmoglobin, a nitrogenous substance, which has great affinity for oxygen, forming oxyhæmoglobin which is a bright red substance. Hence the colour of arterial blood. It also has great affinity for carbon monoxide (CO), and if this be present in the air, which it *ought not* to be, it combines with the hæmoglobin,

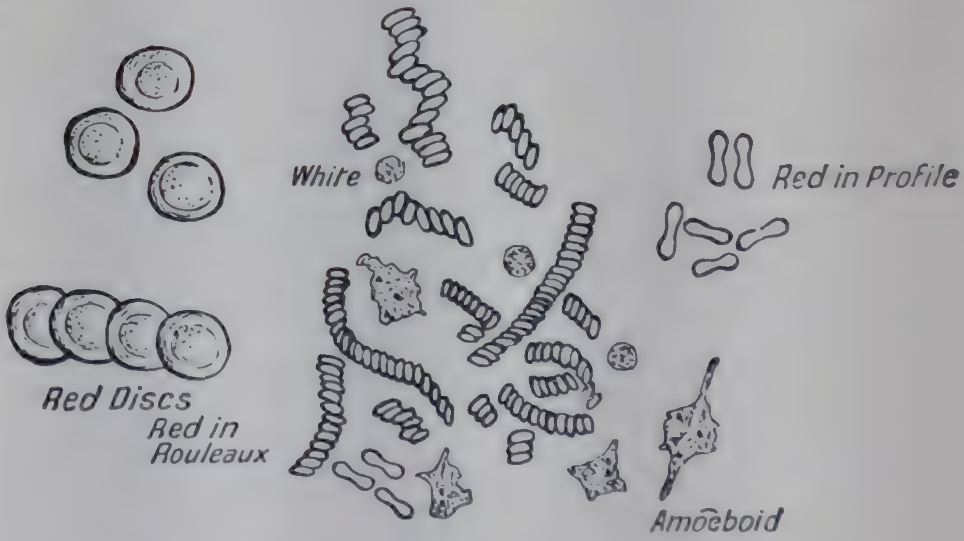

Fig. 21. Blood corpuscles: red, white, and amœboid

(From Narramore's *Preliminary Physiology*. Methuen) forming carboxyhæmoglobin, also bright red. The result is that the corpuscles can no longer take up oxygen, and hence headache, giddiness, faintness and, pretty quickly, death. If this happens at night people often die in their sleep; e.g. the French novelist, Zola, and his wife died thus. Carbon monoxide is the "after-damp" resulting from mine-explosions. Men going into a mine after an explosion sometimes take canaries because these are affected by carbon monoxide more quickly than are human beings.

(*b*) *White corpuscles* (phagocytes) like the amœba are of no definite shape. They are bigger than the red and less numerous, in the proportion 1 : 500, and have the power of independent movement, e.g. they can work their way through the walls of the blood-vessels to any place where they are wanted. Last and chief, they can seize and feed on and therefore destroy small particles such as germs.

The fluid or plasma is the carrier of food, and the remover of waste stuff, such as carbon dioxide, etc.

Clotting. This is a very useful property of blood. When in contact with air, it solidifies after a few minutes into a kind of jelly which often stops bleeding and may save life. In rendering first-aid, never disturb any clot that has formed.

Heart and Blood-vessels. The heart is pear-shaped, about the size of the fist, placed in the centre of the thorax, with the broad end upwards and the apex downwards pointing slightly to the left and resting on the diaphragm. It is enclosed in a double-walled bag, the pericardium, between

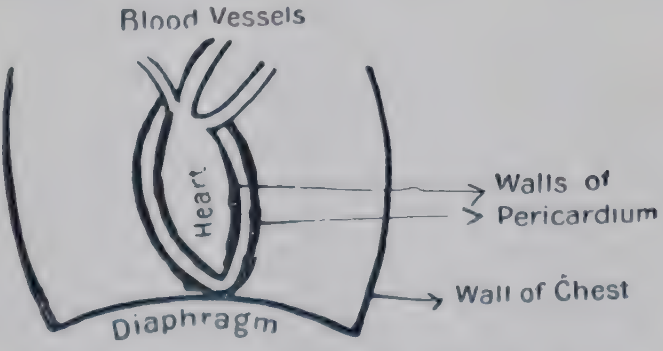

Fig 22. Diagram showing position of heart in thorax

whose walls a lubricating fluid is secreted which prevents friction between the walls as the heart expands and contracts. Inflammation of the bag is known as pericarditis and involves production of too much fluid. The rest of the thorax is filled by the lungs, which wrap round the heart; and just below the diaphragm comes the stomach. Hence any enlargement of either of these, such as occurs in certain forms of pleurisy and in flatulence, means pressure on the heart and therefore interference with its working.

Internal structure. The walls of the heart are built of muscle-fibres running round it transversely. The interior contains four chambers: two upper—the auricles, and two lower—the ventricles. The left auricle and ventricle are connected by a flap-like valve opening downwards only. The right auricle and ventricle are similarly connected.

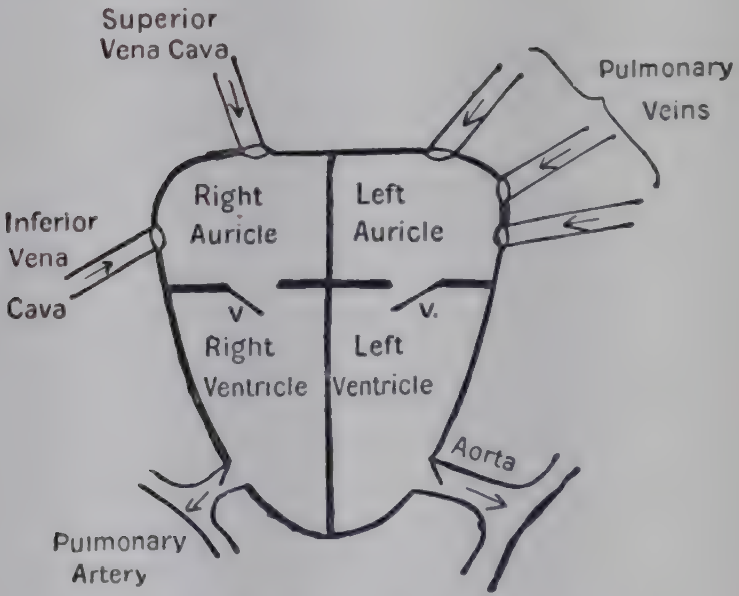
Superior Vena Cava
Pulmonary Veins
Inferior Vena Cava
Right Auricle
Left Auricle
V
V.
Right Ventricle
Left Ventricle
Aorta
Pulmonary Artery

Fig. 23. Diagrammatic section of heart

Blood-vessels. The main vessels either take blood from the heart (arteries) or bring blood to the heart (veins). Their openings are as indicated in the diagram. *The aorta* supplies the whole body except the lungs. The pulmonary artery supplies the lungs. The two veins opening into the right auricle bring back blood from the whole body except the ungs. The three (or four) veins opening into the left auricle ring back blood from the lungs.

The arteries branch continually, after leaving the heart, nd the branches get finer and the walls thinner till eventually hey end in capillary vessels (hair-like). These capillaries nite the smallest arteries to the smallest veins. The very iny veins run together into bigger and bigger ones, the erminals being those shown in Fig. 23. At intervals in the eins occur valves, which are pocket-like flaps, permitting lood to flow past them *towards* the heart easily, but blocking he vein if the blood attempts to flow backwards, away from he heart. Varicose veins result from the breaking down of hese valves.

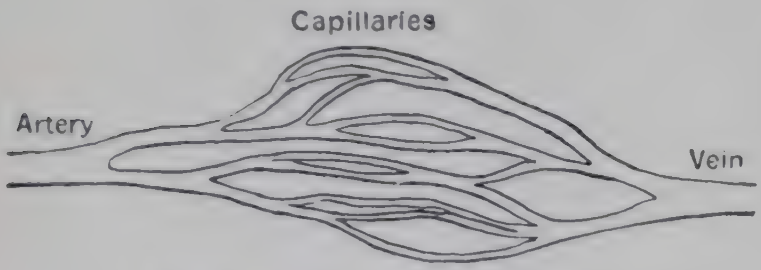

Fig. 24 Union of artery and vein

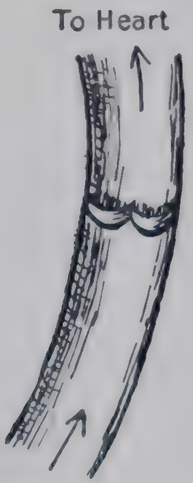

Fig. 25. Vein laid open to show valves

Circulation of Blood is brought about by rhythmical contraction and expansion of the heart muscles. This recurs about seventy-two times per minute in the adult, but quickens in fever and in children; e.g. in a child of twelve the normal pulse is eighty to ninety; in fever it may be one hundred and twenty or more. The heart slows down in sleep. *Contraction* begins at the top of the heart and spreads downwards in a wave to the tip, with the result that the blood is squeezed out of the auricles into the ventricles and from these into the arteries. Valves stop it from flowing back from ventricle to auricle. Then relaxation begins—also in the auricles, which therefore expand and so fill up with blood from the veins. Then the whole thing recurs. The result is that the blood is sent out in a series of jerks, which can be felt as the " pulse " in any artery which comes near the surface of the body and rests on bone. In the capillaries, the friction between the blood and their walls is great, and so the jerking nature of the flow disappears and the blood enters the veins in a steady stream.

The return to the heart is very considerably helped (1) by Respiration; (2) by Muscular Contraction and the presence of valves which prevent backward flow in the veins.

1. *Respiration* means that on breathing out, the pressure of the air in the lungs becomes less than the external atmopheric pressure, and this means a suction of blood towards the lungs, and hence also towards the heart. Obviously, *holding the breath*, which children are very given to doing whilst making an effort to perform some action which seems to them difficult, will retard the return of blood to the heart, so producing a state of congestion in the blood-vessels, and interfering with the circulation as evidenced by the swelling of the veins in the face and neck. The heart makes violent efforts to restore the circulation, and strain and weakening may result. Hence one must always see that this does not happen, and it is doubtful if one should ever do breathing exercises to numbers, since every individual has a natural breathing-period and this differs in different people.

2. When the muscles are contracting, they squeeze the blood in them onwards; when at rest, there is no such

squeeze and so the flow of blood is less vigorous and the whole body suffers from prolonged rest of this sort ; e.g. one is more likely to faint when standing still than when walking. Varicose veins arise from long standing rather than long walking.

Changes in the Blood during Circulation. During its journey round the body, the blood gives up oxygen and food to the tissues and absorbs more food from the stomach and intestines. It carries carbon dioxide (CO_2) and other waste stuff to the lungs, kidneys and skin, which excrete them, and it loses its bright red tint and becomes more wine-coloured. In this state it is pumped into the lungs, where it not only gives up carbon dioxide and water, but becomes re-charged with oxygen, thus regaining its bright red tint. It is then taken back to the heart, to begin its journey round the body again. Hence its functions are probably the most important in the whole body, and if the blood is wrong the whole body, including the Nervous System, suffers. The heart-beat itself depends on the contractile power of the heart-muscles, and this depends on the quality and amount of the blood in them, and so the blood controls that most vital action, the heart-beat.

Necessities for Good Blood. The chief needs are (1) good food and digestion ; (2) fresh air and right breathing, and (3) exercise, of the massive type.

The heart is stimulated to greater activity by physical exercises and its muscle gets larger, firmer, capable of stronger contraction and more resistant to fatigue, as long as the activity does not lead to heart-fatigue or exhaustion. Long-continued or violent physical exercise may strain the heart and permanent weakness may follow, especially if exercise be taken in sudden, violent spurts, e.g. a holiday spent in mountain-climbing after a year's sedentary life.

Running is especially valuable as a heart-exercise, but one must remember two things : (1) to give it in short spells, broken by periods of walking ; (2) that a sudden stop after running is bad because it is likely to produce temporary heart-failure owing to sudden muscular relaxation replacing the contraction which has hitherto been helping the blood along.

Symptoms of Abnormality in Blood or Heart-action. These include extreme pallor, specially of gums, lips or inside of the eyelids ; low vitality ; irritability ; headache ; giddiness ; faintness ; disinclination to play and breathlessness on exertion ; emaciation ; coldness of hands and feet ; blueness of nose, ears, finger-tips.

It is very important that the attention of parents should be drawn to such children. " Go slow " is the rule for them, in work, play and food.

Anæmia. Lack of red corpuscles, or not enough hæmoglobin in them is the cause of anæmia, which is pretty common amongst girls, specially at the age of thirteen to fourteen. The symptoms are pallor, languor—physically and mentally, —headaches, fainting, palpitation, breathlessness, bad or abnormal appetite.

Doctors usually pull down the lower eyelid or lip, as the inside of these is characteristically colourless in anæmia.

As regards treatment ; a little iron often has excellent results. Good food, fresh air and exercise are the other necessities.

Fainting is a form of unconsciousness due to lack or blood-supply to the brain, and this shortage in its turn is caused by failure of the heart-action. This may result from lack of blood in the heart, and may be due to bleeding or to a sudden shock of emotion such as joy, sorrow or fright. Also failure of action may be due to heart-disease, or to blood of poor quality.

If the faint is due to loss of blood it is best not to try to restore consciousness, and on no account should any clot be removed. If it is due to other causes and the preliminary symptoms are noticed in time, it is best to get the patient to stoop, or place the head between the knees, so as to send a rush of blood to the brain. If unconsciousness has set in, the patient should if possible be left lying flat in the place where he has fainted, whilst tight clothes are loosened, windows opened and onlookers dispersed. Raising the legs helps to send blood towards the brain. If the patient has to be moved from the place in which he has fainted, he should be carried out in a horizontal position, so that as little strain as possible is put on the heart. On recovering consciousness he can be given a stimulant, unless the faint is due to loss of blood.

The Lymphatic System. The food and oxygen in the blood osmoses (diffuses) out through the thin walls of the capillaries along with some of the white corpuscles and plasma, and this fluid is called *lymph.* It passes into tiny spaces lying between the cells of the tissues, so that any tissue can be looked on as a sponge of cells with lymph soaked up between. From these spaces branch tiny vessels, the beginnings of *lymph-vessels,* which gradually run one into the other till finally they end in two main vessels :

(*a*) The *thoracic duct* running up the body, in front of the backbone (rather to the left) and opening into the left jugular vein in the neck.

(*b*) The *right lymphatic duct,* which is smaller, because it only collects lymph from the right arm and the right side of the head and neck, and which opens into the right jugular vein. (*a*) Takes all the rest of the lymph.

Glands. At intervals on the lymph-vessels occur bead-like swellings called lymphatic glands, containing numerous white corpuscles, this being one of the places where white corpuscles are manufactured, and passed into the blood with the lymph.

Work of Lymph and Lymphatic Glands. The cells are supplied with food and oxygen by the lymph, and they pass out excretory matter into it, and this is carried on to the veins and so to the excretory organs. Obviously then, if the tissues are to be properly nourished, the lymph must be kept actively moving, and this flow, like that of the blood in the veins, is brought about by muscular contraction, the presence of valves in the vessels, and by expiration. Hence again the need for exercise, and Dr. Kerr recommends running umping or dancing for two or three minutes at a time, at east six times a day.

The glands not only supply white corpuscles to the blood; but act as filters to the lymph which flows through them, because they devour foreign solid matter in it, such as germs, provided these be not too many. If they *are* too many, the process is reversed, i.e. the germs devour the white corpuscles in the gland, producing inflammation and pus (dead white corpuscles) which may break out to the surface, forming what we call an abscess. Hence the glands often enlarge, e.g.:

1. Certain infectious conditions, such as sore throat, scarlet fever, diphtheria and German Measles often enlarge the neck glands.

2. The Occipital glands behind the ear are often enlarged owing to vermin, and consequent scratching and introduction of poison.

3. The Arm-pit glands are often enlarged from a cut on the finger.

4. The Groin glands are often enlarged from a wound on the foot.

5. The Neck glands are specially susceptible to tubercle (scrofula) and therefore the teacher must suspect swollen neck-glands, though they may be due to poison from the mouth (teeth) or throat. Parents should be warned against rubbing such lumps with ointment or embrocation, as friction is specially likely to lead to the formation of abscesses. Also, parents are apt to call any lumps in the neck, due to enlarged lymphatic glands, "Mumps." Mumps, however, is due to inflammation of the Salivary glands, and the swelling is generally slightly higher up and starts on the side of the face, just in front of the lower part of the ear. (See p. 189.)

CHAPTER V

THE RESPIRATORY SYSTEM

Purpose of respiration—Effect on air of room—Effect of bad air on the body—Tests for air—Ventilation and heating—Desirability of radiant heat—Natural and artificial ventilation—Pavilion schools—Mechanism of breathing and voice-production—Types of breathing — Nervous control of breathing — Breathlessness — Mouth-breathing—Adenoids and enlarged tonsils—Physical exercise and respiration.

The Purpose of Respiration is the exchange of carbon lioxide for oxygen, the excretion also of some water and the oss of some heat.

The Effect of Respiration on the Air of a Room. At very breath we take in about 30 cubic inches of air (about hree-quarters of a pint), i.e. only one-twelfth of the total air in he lungs is changed. In *deep* breathing 250 cubic inches can e changed. "*Lazy respiration,*" which is a habit with some eople, may mean only 5 per cent of the air changed. The emaining 100 cubic inches is called "*residual air.*" The air reathed out has about 4½ per cent less Oxygen, 4½ per cent nore Carbon Dioxide, is saturated with water-vapour, is varmed (98.4° F.), and is freer from dust and germs, but has ather more organic matter. In coughing, singing, or any orced expiration we get particles of saliva, mucus, etc., jected, containing many of the germs present in the respiratory tract, hence the desirability of consumptives coughing nto a handkerchief, and of other people not getting too close uring the cough.

The Effects of Breathing Foul Air for a short time are nguor, mental dulness, sleepiness, yawning, headache, intness, nausea or even sickness. If continued day after ay serious and lasting results follow: loss of tone and vitality, poor appetite and digestion, greater liability to infectious disease, especially those of throat and lungs, e.g. consumption, anæmia, bad complexion, eruptions, etc. It also favours rickets in babies.

Cause of these ill-effects. At one time these were ascribed to (1) lack of Oxygen, but stuffy air rarely contains less than 20 per cent and the amount in fresh air is 20·9 per cent, and this decrease has practically no effect on the body. It is a trifle compared with the reduction at high altitudes, many of which are *health resorts*, e.g. Davos Platz in Switzerland, where the barometer stands at 62 instead of 76 cm. of mercury.

2. Then the ill-effects were ascribed to the excess of Carbon Dioxide, but this idea was abandoned because extreme crowding never gives more than 0·7 per cent Carbon Dioxide, and people exposed to twice that amount do not show any bad results, provided the air be kept in motion slightly, and temperature and moisture be not too high.

So the old methods of testing the air of a room by measuring the amount of Carbon Dioxide have mostly been given up.

3. Then it was supposed that the organic matter expired produced the ill-effects, but experiments on lower animals prove that this has no effect.

4. It has been proved experimentally by Flügge that the factors which *do* produce the ill-effects of living in badly ventilated rooms are the *physical* properties, not the chemical properties of the air, and the three that matter are: (*a*) Temperature; (*b*) Moisture; (*c*) Movement. If temperature or moisture be too high we get all the ill-effects already mentioned, but these are less if the air be in motion. Further these factors affect us through our skins and not through the lungs. To demonstrate this, Flügge used an air-chamber full of vitiated air. In this was placed the person to be experimented on, with his head in the outside fresh air. In consequence, he suffered all the usual ill-effects of living in stuffy rooms, but when his head was in the chamber and his body in fresh air he felt quite well. The bracing effect of mountain and sea air is largely due to uninterrupted movement.

Hence, the question arises as to *how* these physical con litions affect the body, and the answer is that they cause eat-retention, one of the surest ways of upsetting any rganism. How do they cause heat-retention? The answer eeds some knowledge of how the body gets rid of its super-luous heat. It does this mainly through the skin (five-sixths r more of the heat lost escapes via the skin), by the two rocesses of (*a*) heating the layer of air next the skin; (*b*) vaporating the perspiration. This needs latent heat, which s absorbed from the skin. Now at once one sees why air that s too hot or too moist causes heat-retention; if too hot there s too little difference between skin and air temperatures, and herefore (*a*) is reduced; if the air is too damp, very little erspiration can evaporate into it, none at all if the air be aturated. Obviously, also, movement of the air will increase vaporation and heating by conduction and convection, ecause it means constant supply of fresh layers of air next he skin.

Tests for Vitiated Air. The best is the Wet and Dry Bulb Hygrometer (Mason's).

Limits for Dry-bulb temperature = 56°–60° F.
„ „ Wet-bulb „ = 53°–56° F.

There should never be less than four degrees or more than ight degrees difference between the Wet and Dry readings. One of these instruments should be in every class-room.

The smell of a stuffy room is *not* a reliable test, as it is ntirely due to lack of cleanliness in the occupants. Many uite clean people can be shut up in a room without producing ny smell.

Ventilation. It follows from what we have said that the roblem of ventilation is to change the air of a room suffi-iently often to stop it from getting too hot or too moist, nd therefore the problem is intimately connected with that of *eating.* One should *heat the body without heating the air,* nd the only way of doing this is to use *radiant heat,* and this, s a practical problem, is still unsolved for schoolrooms, hough one can manage it for living rooms.

1. An ordinary coal fire heats by radiation, though nine-nths of the heat goes up the chimney, so that it is hardly

economical. Also it sends a great deal of air up the chimney, and it is dusty.

2. Gas fires are now made which give fifty per cent radiant heat. They must be properly flued, and have as little ironwork connected with them as possible, as this gets hot and then heats the air. A gas fire of modern make draws much less air out of the room than does a coal fire, and much less heat is wasted. The old type was abominable, with lots of ornamental iron casing and often the gas did not strike the fuel at the right place and so Carbon Monoxide was formed instead of Carbon Dioxide ; hence headaches and various sensations of illness. *Water in front of a gas fire* is quite unnecessary—as long as the fire is not too hot. It is quite usual for people to turn on the gas full and get the room up to 80° F. If used properly it dries air no more than coal.

3. Electric radiators.

The so-called hot-water "radiators" found in school are misnamed. They ought to be called *Convectors*, because they heat the air in contact with them ; this expands, therefore rises, and colder air flows towards the radiator to take the place of what has risen, and so gradually all the air gets hot, which is just what one wants to avoid. It is possible, however, that in the future electric radiators may be more used these being true "radiators" and using no air

Methods of Ventilating Class-rooms.

The two main methods are known as the *Natural and the Artificial Methods.*

A few years ago, Artificial methods were very fashionable, largely owing to the fashion of building *central-hall schools*, which are almost impossible to ventilate naturally. The result was that sanitary engineers hit on the ideas of pumping in air which had previously been warmed, filtered of dust and damped, or of sucking out the air, so decreasing the pressure and making air flow in wherever there was an opening for it. The first of these methods is the Plenum or Propulsion System. The second of these methods is the Vacuum or Extraction system. Nowadays these mechanical systems are out-of-fashion with everyone who is sensible, but they remain installed in many of our big schools owing to the cost and difficulty of replacing them with natural ventilation, this again being due to the central-hall pattern of construction. Hence it is necessary to describe and discuss them briefly.

The *Plenum* system has, in the basement of the building, a fan, driven by electricity or steam, which sucks in air through an inlet which should preferably open high up above the ground, the air being purer near the roof than at street-level. Also, there is a screen of jute or canvas, kept wet by water trickling over it, and through this the air is forced by the fan and thus filtered of dust and damped.

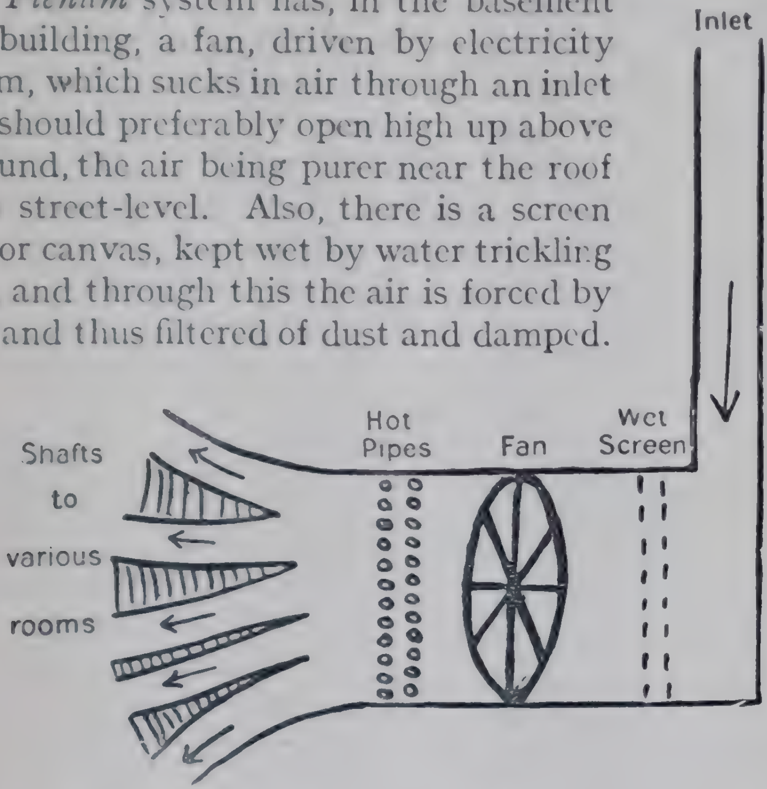

Fig. 26. Diagram of mechanism in Plenum ventilation

It then passes over coils of hot pipes and so is warmed, and then led, by shafts, into each room, entering high up on one wall, sweeping round the room, and leaving by an opening

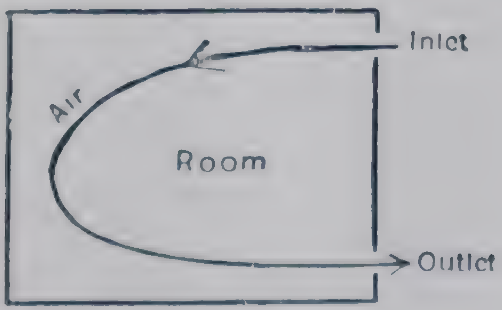

Fig. 27. Diagram of air-current in room ventilated on Plenum system

low down on the same wall. The exit opens into a shaft which runs up into the open air.

The warmed, damped, purified air sweeps out the air in the room in front of it, and it is *possible*, by this method, to keep the air of a room chemically and physically perfect, and yet, granting that the system is working to perfection, which in practice is rarely true, there are very marked *disadvantages* :

1. The noise of the engine and fan, worse in some rooms than others, and exhausting to nerves of both teacher and children.

2. Windows must be kept shut ; in some schools they are made not to open, and this is a bad object lesson to children, who are taught in Hygiene lessons, etc., that windows should be open. Further, if the machinery breaks down, the school is unusable.

3. An almost inexplicable enervating effect, probably due to the *dead physical level* of the air, i.e. the constancy of temperature and humidity, this being felt through the skin. In a naturally ventilated room there are constant little draughts of air of different temperatures, and these, striking the skin, have a tonic effect. Compare the tonic effect of a cold bath.

4. The heating of *air* is bad, since heat is one of the factors producing the ill-effects of living in stuffy rooms, as already explained. Of course in summer this objection does not apply, and heating might be discontinued altogether, but that would mean extra radiators, since at the time when artificial ventilation was fashionable, one of the arguments for it was that it largely supplied the warming of the school, as well as the ventilation.

Vacuum System. Here each room has a duct opening into a central shaft in which a current of ascending air is created, either by a fan at the top, or a fire at the bottom. The result is that air is sucked out of the rooms, and fresh air flows in to take its place, entering wherever it can, e.g. by doors, windows, gratings, etc., and so at once we get one objection, viz. that one cannot control the air-supply, therefore clean it, etc., as one can in the Plenum system. Again, the fan may be noisy. Another objection is that the inlets are necessarily low down, and therefore tend to cause cold feet, one of the predisposing factors to various chest-troubles, since cold feet produce inflammation of the mucous membrane of the nose, and hence liability to "cold in the head," leading on to coughs, etc. This method is used in the House of Commons—and possibly accounts for the cold feet and hot heads of many of the members.

Natural Ventilation. This means ventilation depending on three natural phenomena, viz.:

1. Diffusion of gases.
2. Wind action.
3. Convection, set up by differences of temperature.

1. Of these, Diffusion is not very important; it is the tendency of two gases to mix when in contact, even when one is heavier than the other, and the heavier gas is below the lighter one.

Experiment: Two gas jars, lower containing hydrochloric acid gas, upper containing ammonia gas. Placed mouth to mouth, we get white fumes formed by combination of the two gases to form ammonium chloride, though ammonia is lighter than hydrochloric acid gas and so would remain on top if it were not for diffusion.

Application. If doors or windows be open, we do get some mixing of inside with outside air, even apart from wind, differences of temperature, etc.

2. Wind is more important, though irregular in action. Wind acts in two ways, by *Perflation* and *Aspiration.* Perflation means the sweeping of air through a room in which doors and windows are open, with the result that foul air is driven out. It is a method that should be systematically mployed in playtime, but in our climate is often impossible while a class is in the room.

Aspiration is the suction-action which wind exerts when blowing transversely across an opening such as a chimney.

3. Convection means the flow of currents of hot air up nd cold air down, and depends on the fact that heat decreases ensity, i.e. hot air is lighter, volume for volume, than cold air.

The necessities in a naturally ventilated building are a ufficiency of inlets for fresh air and of outlets for used-up ir. Inlets should be many and low down. Outlets should

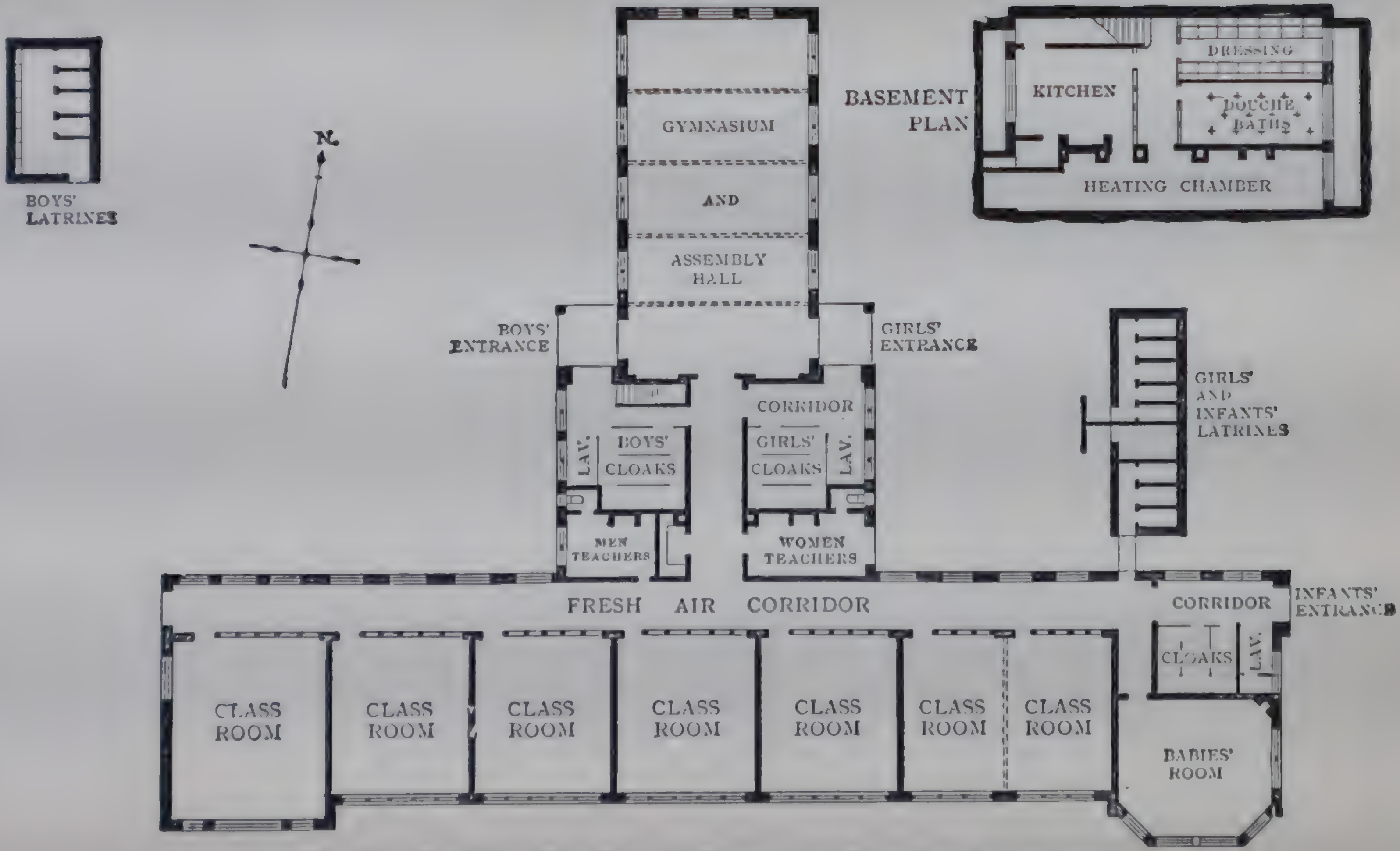
BOYS' LATRINES
N.
GYMNASIUM
AND
ASSEMBLY HALL
BASEMENT PLAN
KITCHEN
DRESSING
DOUCHE BATHS
HEATING CHAMBER
BOYS' ENTRANCE
GIRLS' ENTRANCE
GIRLS' AND INFANTS' LATRINES
LAV.
BOYS' CLOAKS
CORRIDOR
GIRLS' CLOAKS
LAV.
MEN TEACHERS
WOMEN TEACHERS
FRESH AIR CORRIDOR
CORRIDOR
INFANTS' ENTRANCE
CLOAKS
LAV.
CLASS ROOM
CLASS ROOM
CLASS ROOM
CLASS ROOM
CLASS ROOM
CLASS ROOM
CLASS ROOM
BABIES' ROOM

Fig. 28. Bradford City Council Elementary School at Buttershaw

(From Crowley's *Hygiene of School Life*. C. W. Hutt. Methuen.)

be fewer and high up. School windows should be made to open much more than they do. One sees endless schools with plenty of window, but only a tiny fraction of it opens. All windows should be made so that they can be easily opened by the children themselves. The ideal school building must have open air on opposite sides of each class-room, and there must be windows opening on these two opposite sides, so that one can get a really thorough current of fresh air through the room, and this practically requires the Pavilion (or Staffordshire) type of school. Here the building consists of a row of class-rooms opening on to a veranda, in the way shown in the diagram. Each room has sash and hopper windows on the veranda side and on the opposite side. One hall serves all three departments, or in some of the recent schools, one hall serves boys and girls, and the infants have one of their own. Besides the excellence of ventilation, the Pavilion type is cheaper to build, and noise does not travel from hall to class-room, or vice versa, in the way it does in the central-hall type.

But, in any natural system of ventilation, much depends on the teacher. A teacher with what Dr. Crowley calls a dormant sanitary conscience can render the best natural system inefficient, simply by keeping the windows shut.

Aids to Natural Ventilation. These are simply extra inlets or outlets made where windows and chimneys are

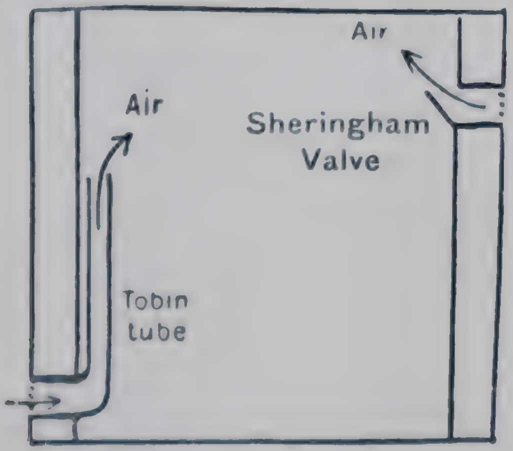

Fig. 29. Aids to natural ventilation

insufficient to provide the needful air. The commoner include Tobin's tubes, Sheringham valves, gratings behind radiators, and various types of roof-ventilators, such as McKinnell's double-tube arrangement, acting as both inlet and outlet.

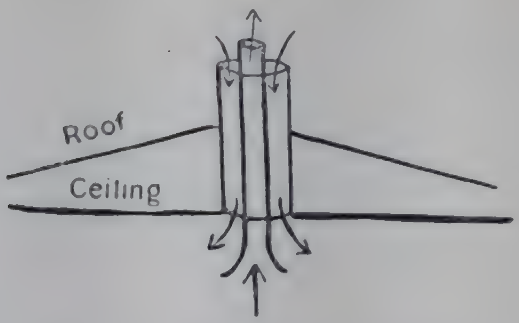

Fig. 30. McKinnell's ventilator

Mechanism of Respiration. The machinery consists of mouth, nose, windpipe, bronchial tubes and lungs.

Of these, the mouth is only legitimately used after or during violent exercise, such as running. The mouth and nasal cavities both open, at the back, into a short, wide tube (the pharynx), which very soon splits into two, the windpipe in front and the gullet behind. The windpipe is about four and a half inches long, and has a swollen top, the larynx, in which " voice " is produced. This forms the projection in the front of the throat known as " *Adam's apple,*" a good deal more prominent in men than in women. The larynx has a lid, called the epiglottis, which can move up and down, so opening or closing the windpipe. It opens during breathing and closes during swallowing, and if one attempts the two simultaneously, the result is that food enters the windpipe and one " chokes," coughs, etc. The walls of larynx and windpipe are built of cartilage. Across the larynx chamber stretch the " *vocal cords,*" two horizontal pieces of membrane, attached to the walls of larynx except at two free edges, between which is a slit (the glottis).

The size of this slit varies in quiet breathing, deep-breathing, singing, etc., this variation being due to the fact that the

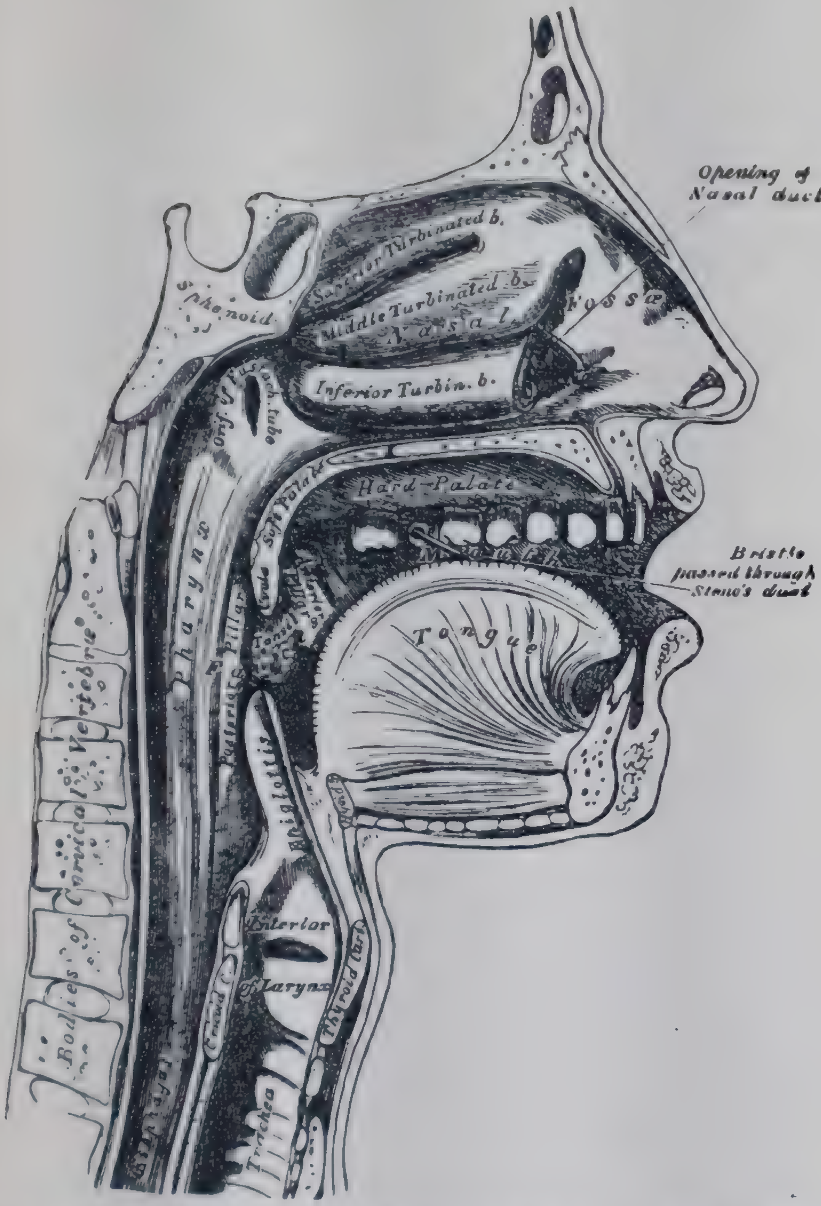
Opening of Nasal duct
Superior Turbinated b.
Middle Turbinated b.
Nasal Fossæ
Sphenoid
Inferior Turbin. b.
Orif. of Eustach. tube
Hard-Palate
Soft Palate
Mouth
Bristle passed through Steno's duct
Tongue
Pharynx
Posterior Pillar
Tonsil
Epiglottis
Hyoid
Interior of Larynx
Cricoid
Thyroid Cart.
Trachea
Oesophagus
Bodies of Cervical Vertebræ

Fig. 31. The mouth, nose, windpipe and gullet seen in section

(From Gray's *Anatomy*. Longmans, Green and Co.)

cords can be tightened up or relaxed by the action of small muscles attached to the cartilage of the larynx-wall. When these muscles contract, the cords are stretched tighter and the glottis narrows, as in diagram.

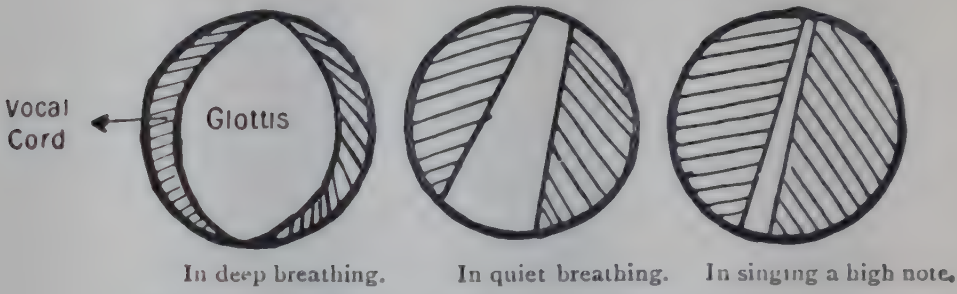

Fig. 32. Section across larynx (diagrammatic)

Voice-production. The air breathed out from the lungs strikes against the vocal cords, and if these be tightly enough stretched, they are set vibrating by the impact and so produce sound, just as a piano wire does when struck, or a violin wire when bowed.

The pitch of the note produced depends on two factors :

1. The tension of the cords.
2. The length of the cords.

The greater the tension the higher the note. The longer the cord the lower the note. Hence it needs less muscular effort to speak on a note of *low* pitch, and I would commend this fact to the notice of all women teachers, for various reasons :

1. Women frequently suffer from loss of voice, a most troublesome condition, and one which can often be avoided by right use of the voice.

2. In giving drill-commands, etc., women tend to let the pitch of their voices rise unduly, so producing an irritating effect on the hearers and unnecessarily straining their own muscles ; and again, a high note " carries " less well than a low one of equal loudness.

The question of *length* of cord explains why a man's voice is deeper than a woman's. The " breaking " of a boy's voice is due to the sudden lengthening of the cords, and, for the year or two during which the growth is proceeding, singing is impossible, and all undue strain on the vocal cords should be avoided, since, in common with all rapidly growing organs, they are very liable to permanent damage if overstrained.

The question of *loudness* is of course different from that of pitch. Loudness depends on the force of the blast of air.

To return to the structure of the Respiratory machinery—the windpipe branches at its lower end into two bronchi, one going to each lung. In the lung each splits up repeatedly into finer and finer branches, which eventually end in tiny air-sacs, giving the whole lung a spongy texture. In the walls of the air-sacs are many capillary blood-vessels. The two

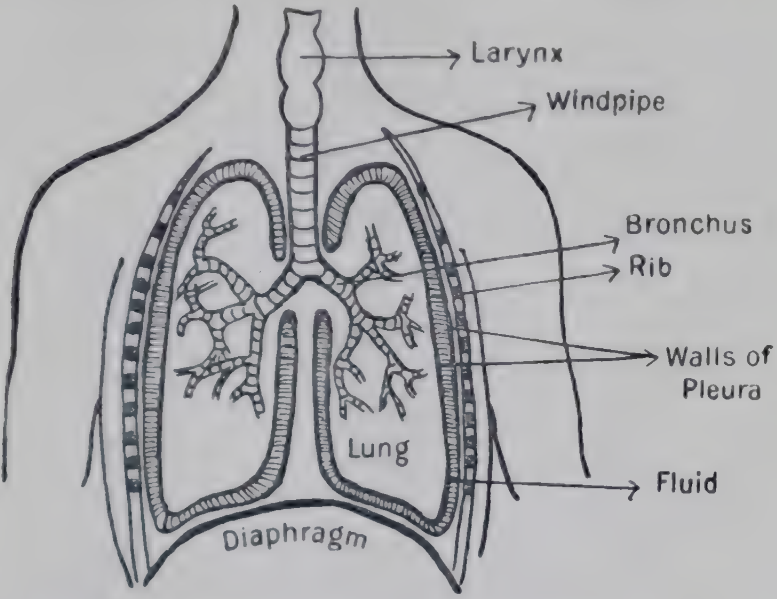

Fig. 33. Diagrammatic section through chest (Heart not shown)

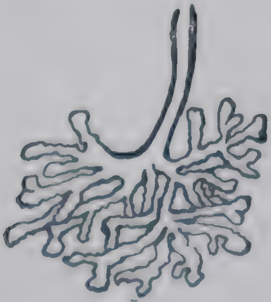

Fig. 34. End of a bronchial tube (diagrammatic)

lungs, together with the heart, fill the whole of the thorax, or chest. Each lung is contained in a double-walled bag, the pleura, resembling the pericardium of the heart in that between its walls is secreted a lubricating fluid which permits of the movement of the lungs without friction against the walls of the chest.

Pleurisy is inflammation of the pleura, brought on by chill, and resulting in over-production of the lubricating fluid, with the result that the heart is compressed, breathing and beating of the heart are both interfered with, and it is sometimes necessary to puncture the outer wall of the pleura to let the fluid escape.

Interchange of Gases between Lung and Atmosphere. This is a matter of the relative pressures of the gases concerned; e.g. the Oxygen in the air has greater pressure than the Oxygen in the blood and therefore passes *into* the plasma, through the thin wall of the capillary, and hence to the hæmoglobin. Conversely, Carbon Dioxide in the blood has greater pressure than Carbon Dioxide in the air-sac and therefore comes out into the air-sac. Obviously, the exchange depends on (1) the circulation and quality of blood in the lungs and (2) the frequency and depth of breathing.

Working of the Machinery. This is purely the result of muscular contraction and expansion in the walls of the chest. The muscles connecting the ribs contract, thus making each rib rise, in the way that the handle of a bucket does when it is resting on the rim of the bucket and you take hold of it. The effect is that the chest increases in width. Further, the muscles of the diaphragm contract, and so pull it flatter, and therefore the chest increases in depth; i.e. the volume of the chest cavity increases; therefore the pressure of air in the cavity decreases below atmospheric pressure. (Boyle's Law.) Therefore air rushes in from the outside till the pressures inside and out are equalised. In *Expiration* the muscles relax and therefore the ribs fall, the diaphragm arches up again, and so the volume of the chest cavity decreases. Therefore the pressure of air in the chest cavity increases above atmospheric pressure. (Boyle's Law.)

Therefore air rushes out, till pressures inside and out are equal.

A simple experiment to illustrate this can easily be fitted up thus :

Take a glass bell-jar, open at top and bottom, and tie over the bottom a sheet of thin rubber (that sold as "patching rubber"), leaving enough slack to take hold of. Into the neck fit a one-holed cork with a short piece of glass tube, to the lower end of which is attached a child's toy-balloon.

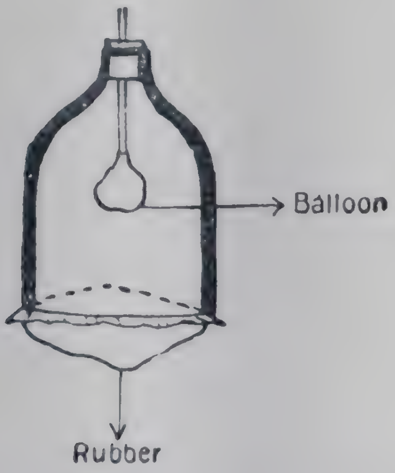

Fig. 35. Dotted line represents rubber pushed up

On pulling the rubber down the balloon inflates, because the volume of the jar is increased and so air rushes into the balloon from outside. On pushing the rubber up, the balloon collapses, because the volume of the jar is decreased, and so air is forced out of the balloon. The rubber represents the diaphragm, the bell-jar represents the chest-wall, the glass tube represents the windpipe, and the balloon represents the lungs. Obviously here the weak point is the rigidity of the bell-jar, which therefore is not a very good representation of the ribs.

Cilia. The lining of the windpipe and bronchial tubes consists of cells from which arise fine threads called cilia (L. cilium=eyelash) which are continually in motion—in jerks—towards the mouth, and so sweep up dust, etc., which may get into the tubes.

Types of Respiration.

Generally respiration is a mixture of two types: *thoracic and abdominal,* though the proportion between the two varies: e.g. men in ordinary breathing use chiefly the lower part of the chest (inferior costal type), while women chiefly use the upper ribs (superior costal type); in children up to seven the breathing is largely abdominal or diaphragmmatic. Both types need developing, because they are complementary.

In children the chest-walls are much more elastic than in adults, a point of importance in regard to chest-expansion and breathing exercises, which are therefore of great value in correcting flat and narrow chest.

Rate varies with age as follows:

Adult	breathes	15–18	times	per	minute.
At 12	,,	20	,,	,,	,,
At 6	,,	22	,,	,,	,,
At birth	,,	44	,,	,,	,,

Quick, shallow breathing in a child usually means pain—due to pleurisy, bronchitis, stomach or liver trouble. Anæmia also involves quicker respiration, owing to the effort to get more Oxygen into the blood. Fever always involves quicker respiration, in the effort to get rid of excess Carbon Dioxide in the blood.

Nervous Control of Respiration. Breathing is governed by a nerve-centre in the medulla (top of spinal cord), and of all the centres governing vital processes this is the only one which is partly under the control of the will, i.e. we can "hold the breath" for a certain time. It also follows that Respiration is open to many influences from all parts of the Nervous System, e.g. emotion, pain, sudden application of cold to the skin. The respiratory centre has a special excitability for Carbon Dioxide and the force of our respiration is entirely due to the Carbon Dioxide in the blood. *Breathlessness*[1] means a convulsive attempt to deepen and quicken breathing, owing to much Carbon Dioxide in the blood. Hence respiration adapts itself to the state of rest or action of the body.

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[1] See Welpton's *Physical Education* for further discussion.

Breathlessness is a sign that the limit of adaptability has been reached, and the respiratory mechanism is being strained beyond its capacity in trying to oxygenate the blood and remove Carbon Dioxide with sufficient rapidity to meet the demands of the body. Breathlessness, if easily produced, is a sign either of poor heart, lungs or blood (anæmic). Rest should be taken or serious injury may follow.

Mouth Breathing and Nasal Breathing. All ordinary breathing should take place through the nose, which is specially fitted to prepare the air for entrance to the lungs. The walls of the nasal cavity are warm, damp, and lined with hairs which filter out dust, insects, etc. The secretion in the nose (mucus) is a disinfectant, and so destroys germs. Hence air entering by the nose, goes down into the lungs warm, damp and filtered of dirt and germs. On the other hand, if taken in via the mouth, it enters dry, cold and dirty and therefore irritates the throat, bronchial tubes and lungs and renders the mouth-breather liable to chronic *sore-throat, enlarged tonsils, bronchitis, consumption, decayed teeth*, and the ills resulting from them, to *diphtheria, scarlet fever*, etc., and to *deafness*, due to spread of inflammation up the Eustachian tubes to the middle ear. Hence a teacher observing a mouth-breather in school should do his or her best to stop the habit, if it *be* a habit only, by constant *correction* and by *breathing exercises*. On the other hand, it may be due to actual obstruction in nose or throat, the remedy for this being removal of the obstruction, and *then* breathing exercises, to teach the right method of breathing. The commonest obstructions are *Adenoids* and *Enlarged Tonsils*, and Dr. Kerr estimates that anything up to ten per cent of children entering school show some degree of adenoid growth or enlargement of tonsils, though certainly not more than five per cent need operation. Every teacher therefore needs to know the *symptoms* of these growths :

The adenoid tissue is situated at the back of the pharynx, close to the openings of the tubes leading from throat to middle ear (Eustachian tubes). The tonsils are two soft fleshy protuberances, one on each side of the pharynx. (See

Fig. 31.) If over-growth of adenoid-tissue or tonsils occur, the opening of the nose into the pharynx is largely closed, and

(*a*) Therefore, *mouth breathing* follows, with all its attendant ills.

(*b*) This gives a *vacant look* to the face, and causes

(*c*) The lower eyelid to rise too far over the eyeball, giving the so-called "*veiled-look*" to the eyes.

(*d*) The *deafness*, which is one of the most serious results, makes the child "spuriously mentally defective," or at least dull and backward, and entails serious educational loss.

(*e*) The nose, not being used, does not develop properly, the nostrils being pinched and the bridge defective.

The teacher should present any child showing these symptoms to the school doctor, and if he recommends operation should do his or her best to see that the parents follow the doctor's advice.

Physical Exercise and Respiration. The lungs can be enlarged and made more capable of work by suitable exercise. "In ordinary breathing the whole of the air-cells are not used and even those used are not expanded fully. Full expansion only occurs during *extraordinary* breathing, when the lungs are filled to their utmost capacity by the full action of the diaphragm and the muscles of the chest and shoulders," and it is by practising *this* kind of breathing that chest capacity is increased. Occasional deep breathing is of very little use, for the muscles and bones of the chest-wall can only be moulded by regular and constantly applied pressure. The best age for developing chest capacity is while growth is still going on, because muscles and bones are both most pliable then. *Deep-breathing exercises* "should aim at expanding the *lower* part of chest where the cross-section is greatest." They should therefore chiefly exercise the diaphragm and the muscles of the lower ribs. Further, they teach nose-breathing. *Other exercises*, less formal, and involving control of breath, should quickly follow, e.g. singing, reciting, walking, running, jumping. In all these the lungs should be filled to the utmost and expiration controlled so that words can be sung steadily, breathlessness not induced, and so on.

Posture in Connection with Breathing. Posture should be such as allows free action of chest and diaphragm. Stooping is therefore bad and so exercises which counteract this are excellent, and correct postures must be insisted on in school.

Games in Connection with Breathing. The more violent the exercise, the more stimulated the lungs. Therefore running, jumping, skipping, wrestling, football, etc., are all good, if regular, and if the natural tendency for breathing to become shallow and rapid be resisted. Hence children should be shown how to take in breath and how to control its expiration when engaged in violent exercise. Inspiration should be deep, full, slow. Expiration should be gradual.[1]

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[1] For fuller discussion see Welpton's *Physical Education*.

CHAPTER VI

THE DIGESTIVE SYSTEM AND FOOD

General structure—Development and care of teeth—Food (uses classes, digestion)—Constipation—Dangers of too much or to little food, and of tainted, diseased, or adulterated food—Beverage (water, tea, coffee, cocoa, milk).

The Digestive System consists of a tube (called the alimentary canal), about twenty-eight feet long, with various enlargements on it, and with various glands opening into it It runs from the mouth to the anus, and we will take its chie divisions with some detail.

The **Mouth** is bounded at the top by a bone called the hard palate, which is continued backwards into the sof palate, formed of muscle covered with mucous membrane, an its back is prolonged into a pink blob, the uvula. (See Fig 31.) Deformity of the hard palate is one of the " physica stigmata " sometimes accompanying mental defect. It ma take the form of *very narrow arched palate*, or of *cleft palat* due to failure of the two halves of the soft and sometimes o the hard palate to unite before birth. If the conditio extends to the lip we get *hare-lip*. The mouth opens into th pharynx, and on each side of the opening are two small sof masses of tissue, the *tonsils*, varying in size a good deal i different people, and nobody quite knows their use. Apparently they are not very important, for their removal doe no harm and often much good. The *tongue*, growing fron the floor of the mouth, is covered with little projection (papillæ) in which are found the ends of the nerves of taste so that the tongue is the organ of taste. It is curious, bu taste is assisted by smell, and therefore if you hold the nos it is much more difficult to taste. Extremes of temperatur more or less numb the sense of taste and therefore a goo way of taking nasty medicine is to wash out the mouth wit very hot or cold water, then hold the nose and swallow.

Teeth. The state of the teeth has such a large effect on eral health that it is worth while to impress the importance good teeth on both children and parents. Digestion and trition largely depend on the teeth, and the results of bad th are : (1) Food is bolted in lumps which the stomach is able to digest and which therefore remain too long in it, gin to decompose and therefore give off the gases which se flatulence and pain ; further, since the food is not orbed into the blood the nutrition suffers, and we get

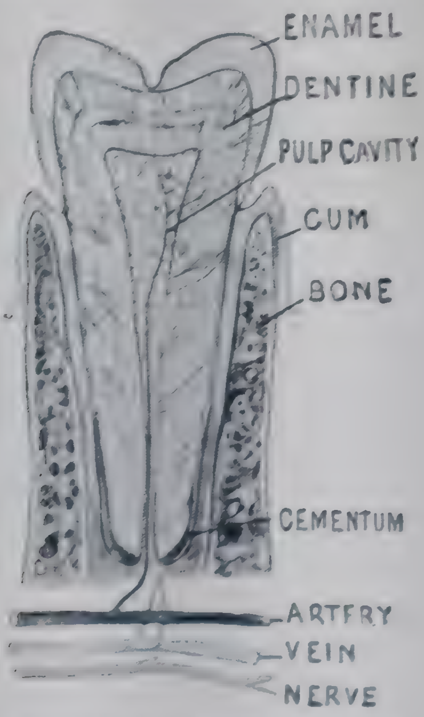

Fig. 36. A longitudinal section of a tooth
(From Pitts' *Care of the Teeth.* Methuen)

r mental or physical development, or both, seriously aging wage-earning capacity and reducing some to semi- lidism ; (2) the pus or matter formed in the tooth is llowed and sets up slow blood-poisoning—hence head- e, blotchy skin, etc. ; (3) the pus makes the breath smell leasant ; (4) bad teeth disfigure their owner ; (5) bad h cause a good deal of bad school-attendance ; (6) the stant irritation of decayed teeth often sets up enlarged phatic glands, tonsils and tonsilitis, and the unhealthy tonsil is probably the gate through which rheumatism enters.

Prevalence of Defects in Teeth. Various observers give numbers from eighty-five to ninety-five per cent of school children, and the thing seems getting worse, probably owing to the soft prepared foods of which we eat so much nowadays. The School Dentists' Society estimates that ninety per cent London children under six years and ninety-five per cent under ten years have decayed teeth. One hundred years ago teeth were much better, and skulls of Ancient Britons, Normans, etc., rarely show decayed teeth.

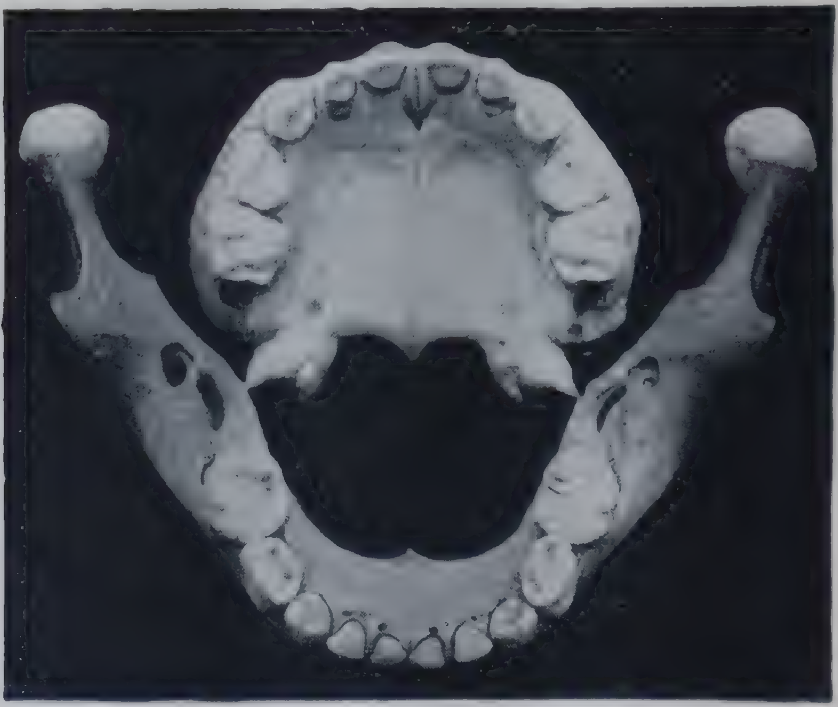

Fig. 37. Upper and lower jaw showing a complete set of temporary teeth

(From Pitts' *Care of the Teeth*. Methuen)

Structure of a Tooth. The tooth consists of three parts: (*a*) crown (visible), (*b*) root (in jaw), (*c*) neck (connecting (*a*) and (*b*) and narrower). The internal structure is shown in the section. The enamel, covering the crown, is a hard white solid, thinnest at the neck. The dentine inside is softer. The pulp contains nerves and blood-vessels, entering by holes in the tips of the roots.

Two Sets of Teeth. (*a*) Milk or first teeth; (*b*) permanent or second teeth. The *numbers* of teeth in each set are shown in the diagram. In the first set we find in each jaw four cutting teeth (incisors) in the centre, a canine tooth on each side of the incisors, and two grinding teeth (molars) beyond each canine. In the second set we get in each jaw four incisors, two canines, four bicuspids and six molars.

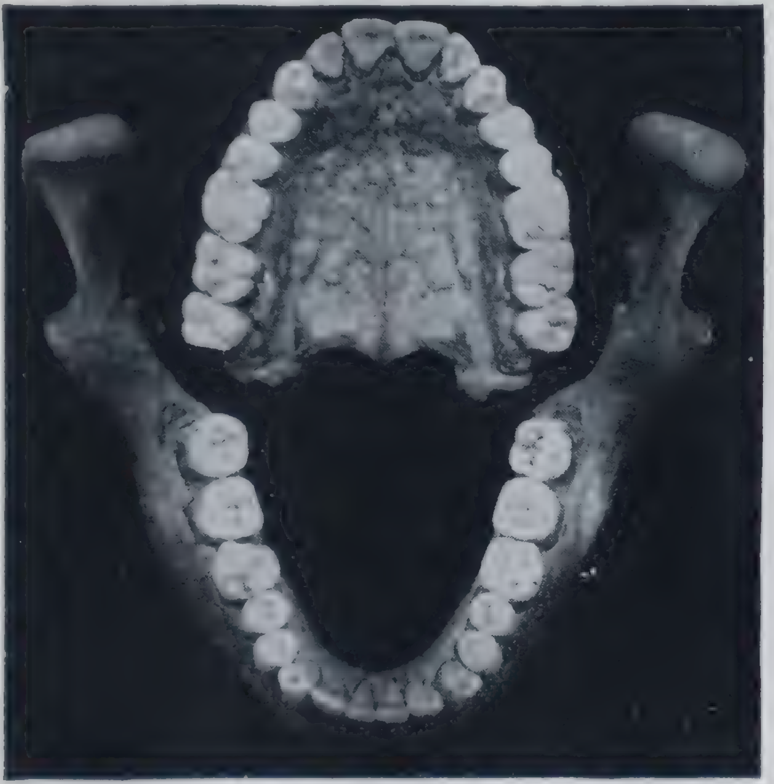

Fig. 38. Upper and lower jaw of an adult showing a complete and perfect set of permanent teeth

(From Pitts' *Care of the Teeth*. Methuen)

Development. The first teeth begin to appear about five months before birth, and at birth all are present in the jaw, though as a rule none are visible. (Occasionally a baby is born with one or two of the front teeth visible, e.g. Richard III and Louis XIV.) Further, at birth, all the second set are present in the jaw, below the first set. The first teeth appear usually about seven months old, viz. *lower incisors*. Then come the *upper incisors*, then the *front molars*, then the *canines*, then the *back molars*, and the set should be complete at two years. At about six years, the first teeth begin to come out, being replaced by the permanent set, and this should be complete, except for the "wisdom teeth," at twelve years. The wisdom teeth may not appear till thirty years old. They are the four last molars.

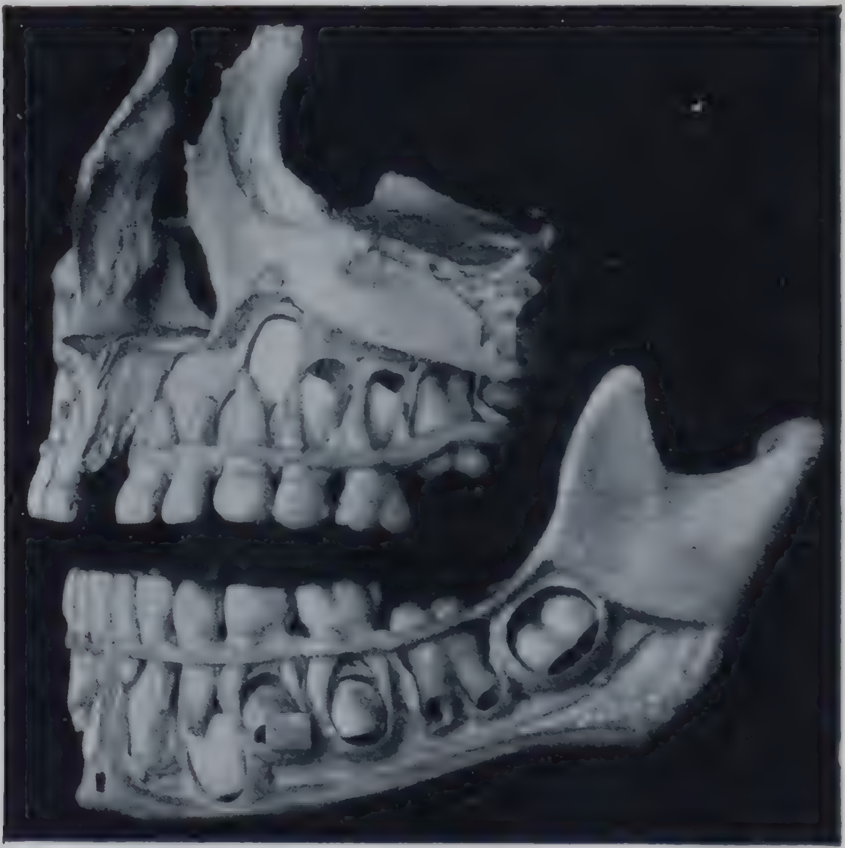

Fig. 39. Upper and lower jaw of a child of six years. The temporary teeth are all present. The first permanent molars have commenced to erupt. The permanent teeth which succeed the temporary teeth are being formed underneath the latter

(From Pitts' *Care of the Teeth*. Methuen)

The *quality of the teeth* is dependent on the general health of the body and varies greatly in different people. Since the teeth form long before birth, the *mother's health* before the child is born affects matters, as well as her health during the time when she is feeding the child; e.g. inherited syphilis' most active during the last three months before and first three months after birth, leads to "Hutchinsonian Teeth," i.e. upper central incisors of the permanent set, appearing about seven with a notch in the centre of the cutting-edge and with rounded edges. Again, the child's food affects its teeth from the beginning. Thus the mother's milk is conducive to better teeth than cow's milk or artificial foods; these latter often leading to rickets, which frequently produces defective enamel. Again, the way in which a child sucks affects its teeth. If bottle-fed, the hole in the teat should not be too big and the teat should be held a little away from the mouth so that the child has to suck hard. This brings increased blood-supply to the gums and hence to the teeth hidden in them. At six months, a baby should be given a chicken-bone to chew or a bit of crust or toast (not too hard) for ten minutes before each meal, to teach it to chew and so get a proper blood-supply to the gums. If it doesn't chew the teeth are ruined. After two years as much hard food as possible should be given; e.g. a breakfast of porridge and milk is bad for the teeth, but it is all right if finished off with cleansing food such as crust or apple. One might mention here the evil effect of "comforters" or dummy-teats on the teeth. They develop the habit of mouth-breathing and this tends to produce a high-arched palate and crowded irregular teeth.

Process of Decay. The actual process is due to the presence in the mouth of acids which dissolve the enamel, usually where it is thinnest, i.e. at the neck. These acids are produced by germs, which are always present in the mouth, and which feed on any food left sticking to the teeth, converting it thereby into acid (malic, lactic, etc.). The enamel having been eaten through, the dentine dissolves faster still because it is softer, and soon the pulp is exposed and great pain ensues whenever food or cold air touches the nerve. A decayed tooth is a centre of contagion to other teeth.

To Ensure Good Teeth. Some of the necessities have already been discussed under "development," viz. good health of the mother before birth, breast feeding, proper sucking and chewing during babyhood. The question of *food* is always more important than that of cleaning, as illustrated by savages, who usually have excellent teeth, no tooth brushes and plenty of raw fruit, bones to gnaw, etc. Hence a meal should end with a bit of crust or an apple in order to remove sticky food which may be clinging to the teeth.[1] *Cleaning of teeth*, however, must be insisted on, and it should begin as soon as there are any teeth to clean, say at eight months, when the mother or nurse should wipe them (not the gums) with a handkerchief or cloth, and long before the child is one year old it should have a soft brush. With school children the thing to insist on is that they clean the teeth the last thing at night, and no last biscuit is to be given after cleaning. No tooth-powder is needed, but the brush should be moved vertically as well as horizontally. In some schools "tooth-brush drill" is practised. In this case one must be careful that the children do not use each other's brushes, since this might spread infection: hence the brushes should be numbered and kept in a rack which prevents contact between them The *dentist* should inspect the teeth annually, during schoo life. The first Dental Clinic in England was opened in 1906 in Cambridge. A good many others have been establishe since.

Salivary Glands. These are the only other importan structures in the mouth. There are three pairs of them: (1 the parotid glands, placed in the cheeks, just in front of th ear, (2) the sub-maxillary glands under the lower jaw-bon and (3) the sub-lingual glands under the tongue. The manufacture saliva from the blood and pour it into th mouth. Saliva contains a substance (ptyalin) called a ferment with the power of turning starch into sugar. This ferment i absent in a baby's saliva for eight months, and therefore i a baby is given starchy food before it is eight months old i cannot digest it—and gets ill.

The mouth opens into the pharynx and this splits, a already mentioned, into two tubes, of which the back on is the *gullet*, a tube about ten inches long, opening into th *stomach*, just under the diaphragm. The stomach is a pea shaped bag with the wider end on the left. Its walls contai transverse and longitudinal muscles which can produc otatory movement of the walls, so churning up the contents, nd it is lined with mucous membrane, in folds and ridges, nd opening into the furrows are the mouths of the stomach-lands, which pour out *gastric juice.* The stomach opens into he *small intestine,* a coiled-up tube, about twenty feet long, illing much of the abdomen, and ending in the *large intestine,* bout five feet long. The walls of the intestines have muscles ike those of the stomach, and the mucous membrane lining

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[1] It has recently been proved that a proper supply of Vitamin D i food is very important in preventing decay. Hence the value of eg yolk, milk, butter, cod-liver oil, etc.

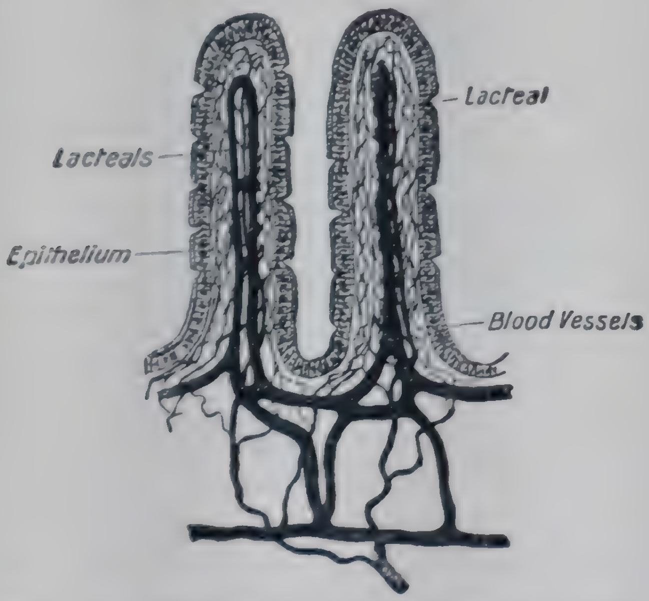

Fig. 40. Villi, showing lacteals, blood-vessels and columnar epithelium

(From Narramore's *Preliminary Physiology.* Methuen)

s flung into finger-like projections (villi) containing capillary lood-vessels and lymphatics. At the beginning of the large ntestine, on the right, is a little tube, about three inches long, he appendix.

Liver and Pancreas. These are two glands, situated as n the diagram, which make important digestive juices, and our them into the small intestine about three inches from he stomach. The liver juice is called *bile.* The pancreatic uice contains four ferments, whose work is described on p. 74.

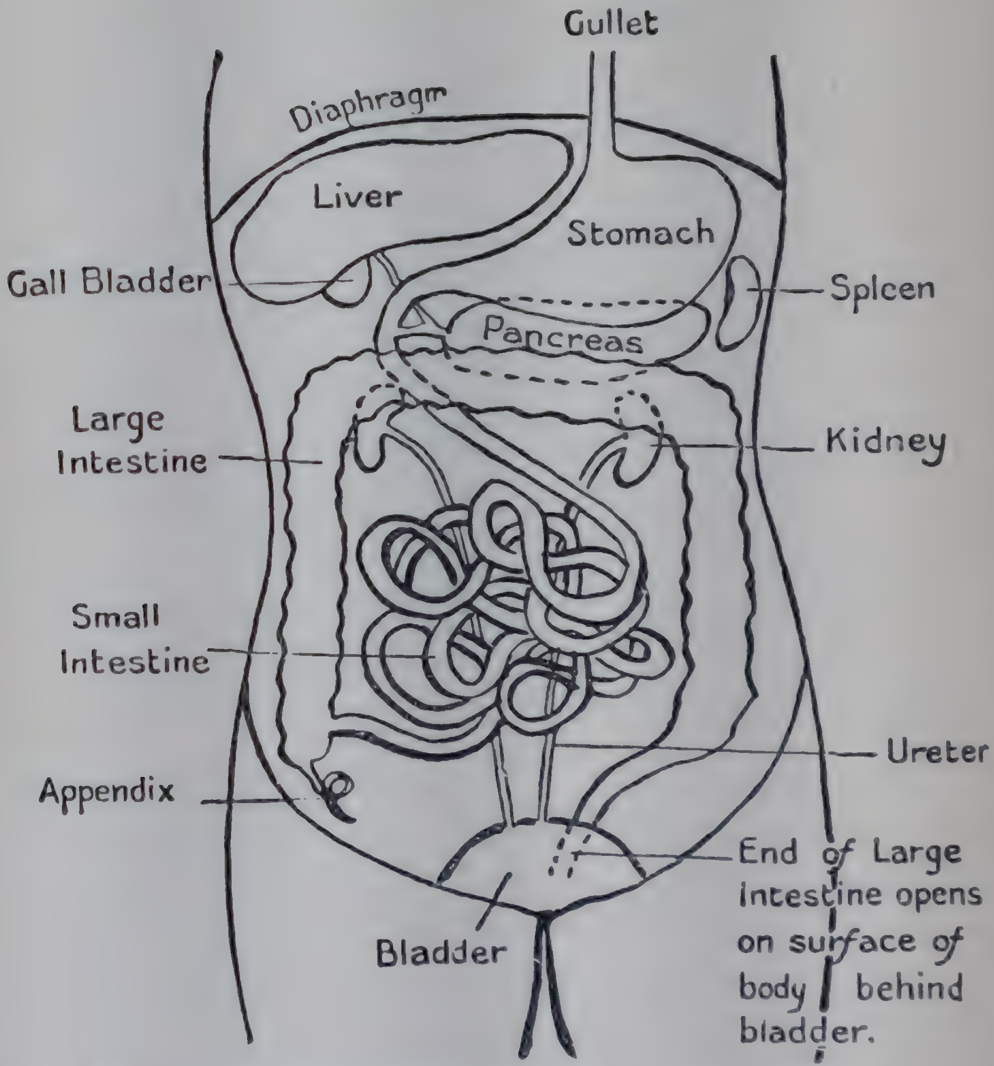
Gullet
Diaphragm
Liver
Stomach
Gall Bladder
Spleen
Pancreas
Large Intestine
Kidney
Small Intestine
Ureter
Appendix
End of Large intestine opens on surface of body behind bladder.
Bladder

FIG. 41. Diagram of some of the organs of the abdomen.

Food.

(*a*) *Functions:* To supply heat and energy; to repair aste; (in children) to build new material. The elements in ood which are most essential in order that it may perform hese functions are Carbon and Nitrogen. Carbon, in the rocess of oxidation to Carbon Dioxide, produces heat and nergy. Nitrogen is the great tissue-forming element.

(*b*) *Classes.* Food is usually divided into the following lasses: (i) *Proteids* or nitrogenous substances, such as meat, hite of egg, the casein in milk and cheese, the legumen in eas, beans, lentils, the gluten in wheat. Since it is only from roteids that Nitrogen can be obtained, a certain amount of his class of food is absolutely necessary. No other class can ake its place. Not all proteids, however, are equally valuable; .g. legumen can provide for wear and tear, but not for rowth. Casein, on the other hand, is adequate to replace aste and for growth. Hence, particularly for children, in hom growth should be taking place actively, peas and eans are not adequate as the only source of proteid. (ii) *arbohydrates*, containing Carbon, Hydrogen and Oxygen, nd including *sugar* and *starch:* e.g. bread, flour, potatoes, ice, root-vegetables, tapioca, semolina, etc., whose function the production of heat and *energy*. (iii) *Fats*, consisting of arbon and Hydrogen, whose function is heat and energy-roduction, e.g. butter, lard, dripping, margarine, cream in ilk and cheese. (iv) *Mineral salts and acids*—the valuable onstituent of green vegetables and fruit, and necessary for he blood, digestive juices and skeleton. (v) *Water*, present in ost food and all beverages. Water accounts for seventy er cent of the body weight.

Freshness of Food. Vitamines. A diet may contain the ight amounts of proteid, fat and starch and yet may be a ailure owing to lack of "vitamines."

These are substances whose nature is not yet completely nderstood, but which are present in very small amounts in ost raw food. They are, however, likely to be destroyed y cooking or removed in "manufactured" foods. They will tand a certain amount of boiling or heating, however, as long s the medium is not alkaline. Their absence causes ill-health, including certain definite diseases, such as scurvy, general neuritis (beri-beri) and possibly rickets; at any rate the disease known as scurvy-rickets is caused thus.

The remarkable effect of administering vitamines in this disease is illustrated by the case of a child brought into a hospital and apparently dying. Whilst the nurse's back was turned the child took some grapes belonging to the patient in the next bed, ate them, and when the nurse returned, was sitting up and smiling.

Hence some raw food, e.g. salad, fruit, etc., should be eaten daily.

When the diet is monotonous, as in the case, for example, of the rice-eating races, the food should not be too much "prepared." Thus beri-beri is caused by living on polished rice, i.e. rice whose outer coat has been rubbed off, and along with it, the vitamine. (See Appendix I, p. 324.)

(*c*) *Digestion* is the conversion of food into a form in which it will pass through the walls of the capillaries in the stomach and intestines. The only food which will do this straight away, without alteration, is *sugar;* hence sugar can be absorbed very quickly, and into the bargain is a useful muscle tonic. It is therefore a valuable food, especially for children. This leaves starch, fat and proteids to be altered. The starch is acted on by the saliva, to some extent whilst in the mouth. Hence the need of thorough chewing and mixing with saliva. One can often taste the sweetness of the sugar actually formed in the mouth as one chews bread or plain biscuit. The process of conversion into sugar is finished in the small intestine by one of the four ferments of the pancreatic juice. *The fat* is acted on by the bile and by another of the four pancreatic-juice ferments, and is emulsified, i.e. broken up into tiny drops which can be absorbed by the *lymphatics* of the intestine. Thus it dodges the liver, whereas all the food taken up directly into the capillaries goes to the liver, via the portal vein. *The proteid* is acted on first in the stomach by the gastric juice, which contains a ferment (pepsin) which converts part of the proteid to *peptone,* which can be absorbed into the capillaries in the stomach-wall. Any not converted here is finished off in the intestine by a hird ferment of the pancreatic juice. During its passage hrough the intestine much of the water of the food is absorbed, so that finally only solid refuse, i.e. the part of the food which s indigestible, remains, and this is excreted from the large ntestine or bowel. *Movement of food* is brought about by what is called "peristaltic action," i.e. the wave-like contraction and expansion of the muscles in the walls of the ntestines. A certain amount of food-stuff is needed to excite this action; hence fairly large meals at fair intervals are better than frequent small quantities. The latter tend o constipation, a condition which needs some mention.

Constipation, commoner in girls than boys, means the accumulation of waste in the intestines. Now germs are always present in the intestine, and if food hangs about, they eed on it, producing poisons which are absorbed into the blood, giving unhealthy complexions, headaches, lassitude, etc. The remedy is dieting, exercise, regular efforts to discharge waste from the bowel, and massage. (*a*) With egard to diet, brown bread and raw and stewed fruit are excellent, the cellulose, which is not digested, stimulating he digestive track, and the vegetable acid helping. Meat hould not be given more than once a day to children. (*b*) *Massage* for five or ten minutes will often produce bowel-action. It must follow the direction of the large intestine, viz. up on the right, across and down on the left of the abdomen. (*c*) Regular efforts to discharge the contents of he bowel develop the habit of regular bowel-action. In this onnection one should note the evil of the child's gulping down a hasty breakfast and then rushing off at once to school. The best and most natural time for the bowel to discharge is after breakfast, and there should therefore be a ttle time between the end of the meal and the child's starting or school. (See Appendix II, p. 326.)

Dangers of too much food. These are less in the case of hildren than with adults, because children are more active hysically than are adults and their digestion and excretion re correspondingly active. The chief effects of excessive food are: (1) Development of fat, due to some of the excess food being changed into this form and stored under the skin, etc. (2) Indigestion, owing to the excess food remaining so long in the stomach and intestine that it decomposes, so causing pain, flatulence and a general feeling of ill-health owing to slow blood-poisoning. (3) Excessive strain on the kidneys, in the case of too much nitrogenous food being eaten, thus probably damaging them and tending to kidney-disease.

Dangers of too little food. This is very harmful if prolonged, and the same holds true if one of the essential classes of food be deficient, e.g. proteid, fat or carbohydrate, and this condition is the commoner of the two. It does not necessarily show itself in thinness, but *some* tissue is badly developed, e.g. bone, muscle or brain—or energy and heat may be lacking. An underfed person is always more liable to disease (especially consumption) than is a well-fed individual.

Variation in amount of food due to work and climate. The less the amount of work done by a person and the warmer the climate the less food does he need. Similarly, warm clothes lessen the need for food, and vice versa.

Dangers of tainted, diseased or adulterated food. Food is easily and frequently rendered unfit for use owing to a variety of causes. For instance, bacteria may get into food handled by a diseased person, such as a typhoid-carrier. A good many outbreaks of typhoid have been traced to this cause. Again, flies may introduce germs into the food over which they crawl, and many outbreaks of infantile diarrhœa, typhoid, dysentery, etc., have been caused thus. Hence the need of a campaign against flies. Exposure of food to dust means inevitably exposure to bacteria, amongst which the tubercle bacillus is common, and hence arises the need o protecting food from dust both at home and in the shop and factory.

The so-called ptomaine-poisoning is due to the presence in food of germs closely resembling the typhoid bacillus, and these may be found in various foods, though chiefly in mea in a prepared or made-up form, such as meat-pies, brawn etc. This kind of food is usually highly flavoured and often made from stale meat of poor quality, on dirty premises The amount of poisoning from this source might be decreased it were made illegal to prepare such foods except on premises en to inspection by the Sanitary Authority. In addition meat, this form of poisoning may be caused by fish, milk, -cream, jellies, etc.

Shell-fish, such as oysters, cockles and mussels living in ater contaminated by sewage, as is so often the case near e mouths of rivers, may cause outbreaks of typhoid and metimes of other disease. The remedy is careful supersion by the Sanitary Authority of the position of all oysterds,—and the cooking of shell-fish.

Bacteria may also be present in the milk or flesh from a seased animal, e.g. tuberculosis germs are common in lk because such a large proportion of milking cows suffer om this disease. Hence we ought to agitate for much more reful inspection of cows and much more stringent eliminaon of the tuberculous animals, for, in the meantime we are iven to sterilise the milk in order to free it from germs, d this may decrease its value by destroying some at least its vitamines.

Milk as a disease-carrier, has a bad reputation, and justibly so, and the more we can impress this fact on the minds the general public the nearer shall we be to the remedy. At sent, cows are often kept and milked in disgustingly dirty ds, their bodies are allowed to become caked with dung, milkers take little care about their own personal cleanliss, the milk-pails are usually not washed out thoroughly th boiling water, if despatched by rail the milk is often ther contaminated with dust, etc., which enters the urn through the ventilating spaces (churns should *not* be ntilated), and at the journey's end still further opporities for entrance of germs are provided at the shop or tre from which it is distributed to the homes. Finally, the home it is often re-infected because kept uncovered, dirty vessels, and in a hot room. The result of all this is t the milk, even if from a healthy cow, is frequently ected with disease-germs by the time it is consumed, and fact accounts for an enormous number of deaths of ies under one year old from diarrhœa, for a considerable mber of deaths from tubercle, specially amongst babies and for various outbreaks of typhoid, scarlet fever and diphtheria.

The remedy lies in attacking the evil at its source, viz. the farm,—and this is no easy matter, for the farmer is notoriously conservative in methods, and rural sanitary authorities are often lax in using their powers. Inspection of farms should be much more thorough than at present, and a real effort should be made to show the farmer by explanation and demonstration that cleanliness pays,—if only in the longer time that clean milk " keeps " compared with dirty milk. Technical schools and institutes might well provide more education for intending farmers, and better arrangements might be made for conveying milk from the farm, both by road and rail, to the consumer.[1]

Animal parasites in food. Fortunately these are not a common danger in England ; in hot climates and in countries where much raw or semi-cooked food is eaten, disease from this source is much more frequent. It is possible to thus contract such diseases as tapeworm and trichinosis, both of which are due to worms which pass one stage of existence (larval or adult) in the ox, dog or pig and the other stage in man. Trichinosis, for instance, is fairly common in Germany owing to the large amount of raw or partly cooked sausage and pork eaten.

Thorough cooking destroys all these parasites.

Food-adulteration. This means the substitution of a cheaper material for the real article, or the addition of chemicals which improve the appearance of or preserve the food, or which get in accidentally. For instance, white bread may be adulterated by replacing some flour by a substance, such as potato, and by adding " flour-improvers " to increase the water-holding power of the flour, and by bleaching with other chemicals, in order to satisfy the stupid demand for whiteness. Copper salts are used to make preserved vegetables, such as peas, look green, and may be harmful. Apart from this most food-dyes are harmless in themselves, but they may disguise bad quality in the food. Preservatives are enormously used to-day in food, and we are all being onstantly dosed, therefore, with small amounts of such hemicals as borax, boracic acid, salicylic acid and its salts, tc., and probably a good deal of indigestion is caused thus. t is not easy to remedy this matter because there are no efinite laws about it, with the exception of the regulation or preserved cream, in which a definite small proportion of oracic acid is legal.[1]

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[1] " Since this was written a great advance has been made in the matter of purity of milk " (see Appendix V, p. 328).

Accidental introduction of poison may occur, especially in inned food. Thus if the tin or solder be of poor quality, if he food be very acid, and if it has been long in the tin, some f the metal may dissolve and pass into the food, but cases f this kind are rare. Again, arsenic has occasionally been ound in sugar, baking powder and beer, having been intro-uced accidentally in the manufacture of these substances.[2]

Beverages.

Water. A good supply of pure drinking water is one of the rimary necessities for the health of any community, and nost towns have realised this fact and have secured, often t great expense, thoroughly satisfactory water. The danger rom water, therefore, occurs chiefly in the country, where solated farms, cottages, etc., often depend on springs or wells. hese may easily be contaminated, especially if surface water an get access to them, e.g. farmyard drainage may percolate hrough the walls of the well, or a leaky cesspool may transmit ewage to a well in the vicinity, and the water from a good nany wells has been found to be thus rendered dangerous. Typhoid germs are specially likely to enter water in this way.

Hence the desirability of the "deep or Artesian" well ather than the shallow well. The former is named after the rovince of Artois, in France, where this type of well was irst constructed, and its essential feature is that it passes hrough the upper porous rock till it comes to the first non-orous layer of rock, continues through this until it reaches he second region of porous rock, and obtains its water from his last region. The sides are concreted, and thus no surface vater from the area round the well can gain access; the water in the well comes from the area where the *lower* porous rock comes to the surface, and this is often miles away from the well itself, on high ground in a country district ; e.g. the fountains in Trafalgar Square are supplied by Artesian wells which bore through the non-porous London clay into the porous chalk below, and this comes to the surface in the Chiltern Hills and the North Downs.

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[1] Since this was written the difficulty *has* been remedied, by the ssue of stringent Regulations as to the use of preservatives. (See ppendix VII.)

[2] For further information see "Food and the Public Health" by Dr. Savage.

It may be wise in places depending on shallow wells or springs, to filter or boil the water before drinking; but if a filter be used it must conform with the rules given in the next chapter.

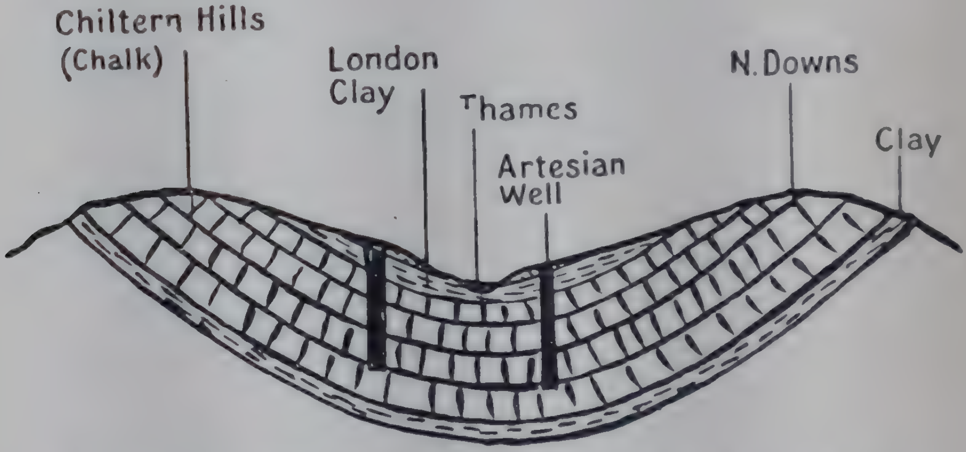

Fig. 41A. Diagrammatic section through the London basin.

Tea is very largely drunk in this country ; during the last hundred years its consumption per person has increased to five or six times what it was originally. It contains two important substances, caffeine and tannin, the amounts of these varying in different kinds of tea, e.g. China contains less than Indian or Ceylon teas. Caffeine belongs to the class of substances called alkaloids, and is a stimulant to the Nervous System ; it is thus useful in moderation, but harmful in excess, since over-stimulation is likely to result in an overwrought, unstable, exhausted condition of " nerves." Tannin is distinctly harmful because it injures the coats of the stomach and hardens proteid foods, to all intents and purposes " tanning " them, and so making them leathery and indigestible. The longer the tea " stands " after making he more tannin dissolves out from the leaves, and hence ea ought to be drunk three minutes after making, or it hould at least be poured off the leaves if it is to be kept. n any case it is unwise to drink tea with or immediately ifter a meat meal. Many women ruin their digestions by eeping the tea-pot always standing on the hob and using he "stewed" tea at frequent intervals.

Coffee contains the same stimulant, caffeine, as does tea, ut it has less tannin, and so is not so likely to cause indi-estion. Hence it is a wiser after-dinner drink than tea.

Cocoa contains practically no stimulant, but it has much nore food-value than either tea or coffee, and hence is far etter for children.

Milk is exceedingly important since it forms so large a art of the food of babies, older children and invalids, and lso, unfortunately, is a very suitable breeding-ground for erms.

It is interesting to compare the compositions of human nd cow's milk, as expressed in the following percentages:

	Human	*Cow*
Proteid (casein, albumen, etc.)	2	4
Fat	3	3·5
Sugar	7	4·5
Salts	0·2	0·7
Water	87·8	87·3
Totals . . .	100	100

In addition plenty of vitamines are present, so that milk ontains all the essential food-classes, and in human milk hese are present in exactly the right proportions for the aby; hence milk has been called a "perfect food," and his is true of human milk, for the human baby.

Cow's milk, perfect for the calf, is not so for the baby, nce it has too much proteid and too little sugar, and further, e casein forms a large clot in the stomach, whereas the asein of human milk forms a much smaller and therefore ore easily digested clot. Hence if a baby is fed on cow's ilk, these differences must somehow be overcome, e.g. y "humanising" the milk, i.e. diluting with water and adding cream and sugar. The difficulty with regard to the size of the clot may be overcome by peptonising or by adding a little citrate of soda, but obviously the baby should be breast-fed, if possible, since its mother's milk needs none of this more or less troublesome adjustment and, in addition, is germ-free.

As long as our milk-supply is of so doubtful a quality as at present, the only safe way is to sterilise milk. This means the destruction of germs by heat, and the quickest method is by boiling for a few minutes, but this, probably, more or less destroys the vitamines also. Milk boils at 91° C. A better way is to put the milk in a vessel of boiling water for fifteen minutes. This raises its temperature to about 80° C. A still better method is to "pasteurise," i.e. heat to 60° C. for twenty minutes, because this kills disease germs without destroying the vitamines or in any way harming the milk, but it is too troublesome a method for the home; it can be and is carried out at some of the larger dairies.

Condensed milk is prepared by evaporating most of the water from milk. In the sweetened brands, sugar is also added, and the viscid liquid is run into tins. The heating during manufacture and the sugar present suffice to free the milk from germs as a rule. The unsweetened brands undergo more heating during manufacture than do the sweetened, because bacteria are more likely to grow in absence of sugar. In both cases it is wise to examine the tins before buying and to refuse any which show outward bulging, as this means that gas has been formed in the tin owing to a growth of germs in the milk. Another very important difference arises from the fact that the original milk may be whole or separated, and condensed milk made from the latter is deficient in fat, and hence is of much less value than that made from whole milk. The two kinds should be clearly labelled. Condensed milk contains fewer germs than does cow's milk, but it is always better to buy tins of such a size that the contents can be used up quickly, since germs may get into the milk when once opened, and may swarm in it in a few days.

As an emergency-food for babies condensed milk diluted with water may be very useful, e.g. on a journey when fresh nilk is unobtainable, or when the child seems temporarily nable to digest cow's milk, but a baby cannot safely be fed or long on condensed milk.

Dried milk is the powder obtained by evaporating all the vater from milk, and is used a good deal in making sweets, iscuits, etc., but from our point of view its importance lies n the fact that it is, under certain conditions, a very valuable ood for babies. It is practically free from germs, and when lissolved in water gives a mixture almost identical with ow's milk in composition, with the advantage that it forms smaller clot in the stomach, and hence is in this respect nearer o human milk and correspondingly more digestible. Opinion liffers as to whether the vitamines are destroyed in dried nilk ; but if so, probably they are only partially removed, for lried milk does not cause rickets.

CHAPTER VII

FOOD (*continued*)

Children's diet—Cleanliness of food, filters, contamination by flies——Nutrition and malnutrition—Feeding of school children: selection of children, arrangements for preparing and serving meals, educational value, rickets.

Advice as to Children's Diet. (1) A child must be *trained* to eat proper food, for it usually wants the things worst for it. (2) The habit of chewing must be taught. (3) Starch is bad in excess, partly because it is insoluble in water and often sticky and so it clings to the teeth. Sugar is *not* bad, for, being soluble, it does not cling to the teeth, and also it is very quickly digested, and so can quickly supply the demands of the body for heat and energy, these demands being, relatively to its size, greater in the child than in the adult. Hence the craving for sugar is quite natural, and should be satisfied *at* meals, after the appetite has been largely satisfied on other things. I lately came across an illustration of the reviving effect of sugar. A friend with whom I was having tea said that he did not like sugar in tea, except when he was very tired, say after a long bicycle ride, when he felt a craving for it. He knew nothing of the food-value of sugar, and his testimony to it was quite unconscious. Sugar can often supply a stimulus to people who otherwise might try to obtain the same energy from alcohol,—with its much greater risk of ill-effects. Hence one should think twice before trying to check a taste for sugar in another person. (4) There is a tendency for children not to get enough fat, and the need for fat must be impressed on parents. The reason is that fat produces *heat* more than any other kind of food and the child loses heat faster than the adult because the skin is thinner and its area bigger in proportion to the weight of the body. In babies lack of fat produces *Rickets*. (5) There is no special brain-food. (6) Do not be alarmed at a *child's* appetite, which should be specially big from 10–14 n girls and 14–20 in men. (7) Rest after meals is desirable, ncluding at least half an hour between dinner and lessons, because the blood is diverted to the digestive tract and if drawn off to the brain, both digestion and intellectual work suffer. (8) Too hot food is bad. (9) Drinking between meals is best. (10) No work should be done before breakfast (cp. Munition Workers Committee's Report). (11) No *heavy* meal should be eaten later than three hours before bed. (12) Fare for children should be plain, wholesome, varied, digestible, and for elenentary school children, cheap.

Articles of Food specially suitable for School Children. (1) *Porridge* with milk, finishing with a crust, apple, etc. Oatmeal is largely starch, but contains more Nitrogen than any other flour. Hence with milk it supplies all the necessary food-constituents. The Scotch largely live on it, and their physique is excellent. (2) *Milk* is the perfect food for babies, and a very valuable one at all ages, since it contains proteid, fat, sugar and water. (3) *Cheese* is half fat plus half proteid and therefore is very nutritious and should be much more eaten by the poor than it is. (4) *Fish* is more ligestible than meat, and one can usually get some kinds heaply, e.g. herring. (5) *Dried peas, beans and lentils* contain nuch proteid, starch and B vitamine, and therefore supply ery valuable food. Most vegetarian meat-substitutes conain them. It must be remembered, however, that though dequate for wear and tear they are inadequate for growth, nd so must be supplemented by other proteids, e.g. the asein of milk, or myosin of meat. They do enable one to *educe* the amount of meat needed. If soaked for twentyour hours and then kept damp but exposed to air until they egin to sprout, they develop C vitamine also, and incidenally need less cooking. A good way is to put the soaked eeds between damp cloths on a sieve till they sprout. 5) *Eggs* are very nutritious, the white being proteid and the olk fat, rich in A and B vitamines. (7) *Brown wholemeal read* is better than white because it contains vitamine, proteid and salts, and the husk helps to prevent constipation. (8) *Dates* are cheap, very nutritious and digestible; their large use by the Arabs illustrates their value. (9) *Figs and prunes* are also good. (10) *Margarine, dripping, bacon fat* and *butter* are all good. (11) *Fresh fruit* is specially valuable for the C vitamin it contains. Nuts are very nutritious and rich in B vitamine. *Stewed fruit* such as rhubarb is good. (12) *Suet and batter puddings* with honey, treacle or sugar are good, but containing fruit they are better still. (13) *Cocoa* is better than tea or coffee because it has more heat-value, less stimulant and less tannin.

Cleanliness of Food. (1) *Water.* In most towns nowadays there is no need to filter water, because it is supplied in fit condition to drink by the Water Company or by the Municipal Authority. Often it is brought long distances, and it is usually filtered before being supplied to the houses, e.g. Manchester is supplied from Thirlmere; Birmingham from Mid-Wales; Glasgow from Loch Katrine. In any case, the supply should be such as to do away with filters because it is impossible to maintain a sufficient standard of cleanliness in filters. Every filter needs cleansing or renewing once a week, and this is a hard thing to get done—by servants or by a busy housewife. In most cases the water coming out of a filter is more impure than when it entered. However, a filter *may* be needed, e.g. in epidemics of typhoid (enteric), and then it must be a germ-filter, scrubbed and boiled weekly.

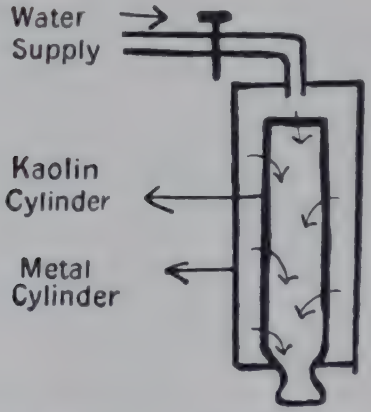

Fig. 42. Section through Chamberland-Pasteur Filter.

The two types fulfilling these conditions are the Berkefeld and the Chamberland-Pasteur. Here the filter is made of infusorial earth or of kaolin, both of which are porous, but stop even such tiny solid bodies as germs. One pattern can be fixed to an ordinary tap and is therefore very convenient. The cylinder of kaolin can be removed from its metal case when cleaning is needed.

(2) *How to stop contamination of food by flies.* For the facts and suggestions given here see article in *Journal of the Royal Sanitary Institute*, March, 1917, by Dr. Joseph Cates, and the Discussion on it. The majority of deaths from food-poisoning in children are brought about by contamination of food by flies. The two outstanding symptoms of food-infection in children are sickness and diarrhœa (enteritis). The latter is a wholesale killer of children. In England and Wales 20,000 children under five die annually. It occurs almost exclusively in the three months of July, August and September, and much more in hot years, i.e. when flies are most active. It is pretty certain that flies act as carriers because the germs are often found in them. The disease is very common in slums with bad backyards. When local Sanitary Authorities abolish open ash-pits, earth-closets, ill-swept streets, and remove refuse quickly they will have done a great deal towards lessening the disease, for the house-fly lays its eggs in fermenting vegetable matter and whilst crawling over it gathers germs and so contaminates the surface of the material on which it next alights. Therefore the first step is to stop flies breeding, and stable manure should therefore be stored in fly-proof receptacles emptied at least weekly in summer and autumn. Other likely breeding-places must be dealt with similarly, e.g. ash-bins.

To free a house from flies there is nothing equal to the sticky fly-paper, or lengths of wire or string dipped into some suitable sticky stuff. Wire cages or glass vessels baited with attractive material can be kept in each room and people wanting sport can slay flies with the nice little flails now sold for that purpose. A little paraffin in the water used for cleaning windows is excellent, and paint can be wiped over with a cloth moistened with paraffin.

All food, especially milk, sweets and fruit, should be screened from flies, in safes or cupboards. A cheap safe can be made from a sugar box with the sides partly cut out and gauze inserted, and with a gauze curtain to cover the front. In pantries, gauze curtains can be suspended in front of shelves. Gauze covers should be used for basins, jugs, etc. It is not unusual to see a baby's bottle left on the table after being used by the baby, with the stopper out and several flies in it. It is rarely sterilised or even washed before being used again. Again, in some houses food is left on the table for hours. In shops, fly-proof and glass cases and muslin should be used. In certain trades more use should be made of cold-storage chambers, and meat and fish should not be exposed to the dust and dirt of the streets in the summer. It would help if customers refused to buy things over which flies were crawling. Not only summer diarrhœa can be conveyed by flies, but also typhoid, dysentery, some forms of tuberculosis, etc. Many of our Colonies have realised the importance of the contamination of food by flies, as shown in their by-laws; e.g. *Auckland* (New Zealand), in 1909, brought in regulations to prevent fly-infection in butchers' shops. *Toronto*, in 1911, passed a by-law prohibiting exposure of any food unless covered to protect it from dust, flies, etc. *Sydney* refuses to allow milk to be kept in dairies unless in a fly-proof safe. Various devices exist for so covering the food that it may be visible, and ventilated, and not under glass, which traps heat and so injures food; e.g. mosquito netting on iron frames, with trap-doors through which customers are served. *In School*, all children should be taught how flies contaminate food.

Nutrition and Malnutrition. The Chief Medical Officer of the Board of Education, in his Report for 1914, says "sound nutrition is a general physiological condition which connotes a healthy body in all respects and the good tone and health of its various constituent parts, its brain and nervous system, its muscular, digestive, circulatory and lymphatic systems. All this means that we must take a wide and comprehensive view of nutrition, which is a state revealing itself in a variety of signs and symptoms. Thus, in endeavouring to estimate

child's nutrition or its opposite (viz. malnutrition), we must
ink not only of bulk and weight of body, but of ratio of
ature to weight ; of the general balance and 'substance'
the body and of its carriage and bearing ; of the firmness
the tissues ; of the presence of subcutaneous fat ; of the
ndition and process of development of the muscular
stem ; of the condition of the skin and the redness of the
ucous membranes ; of the nervous and muscular systems
expressed in listlessness or alertness, in apathy or keen-
ss ; of the condition of the various systems of the body,
d, speaking generally, of the relative balance and co-ordina-
n of the functions of digestion, absorption and assimilation
food as well as of the excretion of waste products. It is
vious that these are data which are likely to lead to a much
re reliable opinion than the consideration of any one
ctor or ratio . . . and these data will demand a wider as
ll as a more careful and accurate observation of the whole
ysique of the child."

Causes of Malnutrition. The Report points out that a
od deal of attention has lately been devoted to investigating
ese causes, with the result that the following factors,
nongst others, have been found to govern the condition : (1)
od-insufficiency and unsuitability. (2) Bad home sur-
undings and neglect. (3) Lack of fresh air and sunlight.
Unsuitable sleeping arrangements—want of ventilation
d overcrowding in bedrooms, insufficient sleep. (5)
nployment out of school hours. (6) Want of cleanliness.
Unhealthy school conditions. (8) Congenital debility.
Disease (mouth-breathing, decayed teeth, adenoids,
nchitis, suspected tuberculosis, rheumatism, etc.). (10)
nsuitable attendance of young children in rural areas.
e majority of investigators lay special stress on three of
se causes, viz. : (1) Unsuitable food ; (2) enlarged tonsils,
noids and tuberculosis ; (3) insufficient sleep. Thus
. *Orr, of Shrewsbury*, says : "The subject of unsuitable food
very important. The women of the working classes show
urprising ignorance of the proper methods of cooking for
nily requirements, a want of knowledge of the value and
tability of food-stuffs, and too often a general incom-

petence respecting household management. One is incline to attribute a good deal of this want of knowledge to th absence of proper education with respect to these subjects and support of this view is afforded by the results from th education of mothers at the School for Mothers. Here the receive instruction in 'cooking cheap but nutritious an suitable meals for families and in general house-management This instruction is received with the greatest enthusias and interest by the women concerned and much good results.

Dr. Macdonald, of Northampton, reports : " This conditio of Malnutrition is hard to define scientifically, and any tw observers might show widely different figures from examina tion of the same children. In the majority of cases there i nothing tangible, but the children give to the observer th feeling of their not being just right. Some of them belong t the group that, for lack of a better name, we designat pretuberculous. Others are frankly adenoidal, while many ar suffering, not from insufficiency of food (that, I think, is fa from common in Northampton), but from bad food and badl prepared food. The quantity may be there, but the qualit and proper selection are absent. White bread, made of po quality flour, and potatoes form the staple of many dietarie

" Another potent factor in the production of chron dyspepsia which is, I believe, much more common among children than is generally thought, is the all-pervadin antiseptic preservative. This is not restricted by any mea to tinned products, but in the form of boric acid, formali salicylic acid, and so on, haunts our fresh butter, mil cream and other comestibles."[1]

Dr. Halliwell (*Dewsbury*) states that " malnutrition frequently associated with adenoids and enlarged tonsil It must be emphasised that children who show signs malnutrition are potential if not actual harbourers of th tubercle bacillus." *Dr. Hamer* (*London*) says : " Tuberculos in one form or another is a cause of malnutrition in ov twenty-five per cent of the cases where any cause is assign and the parents are urged by the Care Committees to atte the local tuberculosis dispensary or other institution whe reatment can be got." *Dr. Meredith Young* (*Cheshire*) says : ' Many of the poorly nourished children come from good iomes and are accompanied at the examination by their nothers. This class of child may have defective assimilation lue to hidden sources of sepsis, e.g. dental abscess, or septic onsils, defective digestion, intestinal parasites and tuberulosis. This last is so strongly suspected as the most frequent ause of malnutrition that it has been stated ' Malnutrition s Tuberculosis.' " *Dr. Roberts* (*Denbighshire*) says : " Insuffiiency of sleep is another cause which unquestionably has a leleterious effect on the growth and healthy development of he school child. One feels that the evil habit of late hours is ecoming more general. Children of tender years who hould be in bed, crowd into the poisonous atmosphere of icturedromes, and before long it will become essential to nake regulations controlling the admission of children to uch shows, as the question is becoming one of vital importnce."

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[1] This evil has now been dealt with, in stringent Regulations. (S Appendix VII.)

Prevalence of Malnutrition. The 1916 Report of the hief Medical Officer of the Board of Education gives ten er cent children as sub-normal, say 600,000 children, there eing a higher percentage in town than in country.[1] London s an exception to this rule, probably owing to the large umber of organisations in London for the protection of the ublic health and the improvement of insanitary conditions rising from uncleanliness and overcrowding. The good ecord in the country is due to more fresh air and sun and onger sleep (no cinemas and less employment out of school, t any rate before the War).

Methods of Dealing with Malnutrition. (1) Visits to the omes by the school nurses give " opportunities for homely lks with parents on the benefits of fresh air, sunlight, gular, suitable and sufficient meals and a proper amount of eep." (2) " The Juvenile Employment and Advisory ommittees brought into existence since the passing of the abour Exchanges Act, 1909, and the Education (Choice of mployment) Act, 1910, have, by association with the staff the School Medical Service and in other ways, been instruental in obtaining reform in connection with some of the flagrant cases of excessive juvenile employment which have been brought to their notice." (3) The provision, by local Education Authorities of medical treatment for physical defects is removing the causes of malnutrition in many cases. (4) The provision of meals by Education Authorities corrects many cases of malnutrition. (5) Some Authorities provide Cod Liver Oil, etc., e.g. Newbury, which is a rural area with twenty-four per cent of children with nutrition below the normal, provides hot milk in the middle of the morning in school for a small cost. Nottingham supplies children with Extract of Malt and Cod Liver Oil at wholesale cost price. (6) Many of these malnourished children are suitable subjects for Open-Air Schools. They should have the first claim to any open-air education provided.

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[1] In 1930, out of the [illegible] children medically inspected, 20,870 ffered from malnutrition, i.e. only 1·1 per cent. This means a remarkle improvement.'

Feeding of School Children. This matter is dealt with in Section XI of the Report for 1914 School meals are a means of more or less patching up the condition of malnutrition. Up to 1906, school meals were entirely supplied by charitable organisations, but in that year the Provision of Meals Bill empowered Local Authorities to help voluntary efforts for feeding underfed children by providing buildings, furniture, apparatus and also food, to the extent of a halfpenny rate. The cost can be recovered from parents able to pay. In August, 1914, a few days after the beginning of the War, a fresh Act was passed, legalising the provision of meals during holidays and on other days when the school is not open, and repealing the limit previously placed on expenditure, and giving Grants in aid of Free Meals. In most cases these Grants have been fifty per cent of the Authorities' expenditure. Since the War the number of children requiring free meals has decreased largely, owing to high wages and separation allowances. In the year ending March, 1915, meals were provided on 5 days a week by 65 Authorities, on 6 days a week by 44 Authorities, and on 7 days a week by 23 Authorities. In 109 areas meals were supplied during part or all of the holidays. *Canteen Committees* are appointed in each area and they voluntarily undertake much work. The Board of Education has issued a Memorandum on methods of providing meals and on suitable dietaries (Circular 856) which has been f great use in improving local arrangements, e.g. in varying enus according to season, etc. Far fewer Authorities now eed their children at eating-houses or restaurants, which are ndesirable from many points of view. Again, there is *some* icrease in co-ordination between Free Meals and School Iedical Service—though not as much as there should be. Iowever, the arrangements differ very much in different reas, and in most improvement is desirable.[1]

Selection of Children. Must be *mainly* done by teachers, or the obvious reason that they have the best chance of bserving the children. They should not be asked to underake any duties connected with organisation or supervision, ut all teachers should watch their children's general health, nd report cases of ailing children. In most cases they do is admirably. In addition, parents can apply direct for eals for their children; and School Doctors, Nurses, Iembers of Care Committees, Attendance Officers, etc., can ll report cases to the Canteen Committee.

Place of the School-doctor. He "should both supplement nd correct the lists prepared by teachers" and others. As oon as possible he should examine the children selected to e that they are getting the right treatment, for malnutrition not *solely* due to underfeeding or wrong feeding. He can xamine them at the School Clinic as "specials" or note eir condition during visits to the Feeding Centre. Some ildren will only require medical treatment; some children ill only require meals; some children will require both. The Authorities are using their School Medical Service and eir organisation for meals in a wasteful and unproductive ay, unless at the earliest possible stage each child's trouble diagnosed and medically treated."

Premises for Meals. These differ greatly in different eas. Sometimes Central Kitchens belonging to the uthority cook the food and distribute it either to dining alls specially taken for the purpose or to schools. Somemes the food is both cooked and served in hired premises, in the school, or in Cookery Centres. Sometimes the food cooked by caterers and served in halls engaged by the uthority or in the school. In a few cases (rapidly decreasing) it is served in restaurants. These various methods all have advantages and disadvantages, e.g. the school is a *good* place in that it is easier to get the services of teachers here, and order is better if teachers are present. Also it is easier for children to be punctual and to rest after the meal. It is *bad* in that if the food is cooked at school a separate cook and supply of apparatus are needed for each school ; also suitable accommodation is not always available ; also ventilating is interfered with. Usually it is best to select a few convenient schools as centres to which children from other schools can go. Dining halls have many advantages from the point of view of organisation and economy, but it is not so easy to make the meal a civilising and educating influence where you have a very big number present. Hence small tables with plenty of assistants are good. *Cookery Centres* are good because the children can help cook the meal. At one such centre the cost was about twopence per head, the meal was served in the Infants' Hall, at trestle tables covered with oil baize. The infants sat separately, at kindergarten tables, and wore bibs made in the needlework classes. The tables were decorated with flowers and the boy monitors helped lay them. Elder girls helped to wash the younger ones' hands. Children said Grace, behaved quietly and enjoyed their meal. A teacher supervised.

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[1] During the year ending 31st March, 1929, the number of children l was 191,178, and the number of meals provided was 20,131,035. 1930, owing to industrial depression, the numbers were much larger.

Arrangements at Feeding Centres are suggested in the Board's Memorandum (Circular 856). Many Authorities have issued printed instructions, and the following are extracts from these : (1) Teachers should send children out to dinner in time to get to the Centre punctually, and should see that they wash before leaving school. (2) Meals should be of educational as well as of physical value. Disorder or too rigid discipline are therefore to be avoided, and a spirit of homeliness and cheerfulness cultivated. (*a*) Children should be seated before the meal begins, and should say Grace. (*b*) They must not be allowed to eat too fast, and nobody should get up till *all* have finished. (*c*) Children should not be kept waiting outside in cold or wet weather. (*d*) Cheerful talk during the meal should be encouraged along with politeness of request and thanks. (*e*) Clean hands and faces should insisted on and children should be taught good manners, . how to use spoons, forks, knives, not to spill food, to nsider the wants of others, etc. (*f*) No food must be taken ay. (*g*) Punctuality must be insisted on. (*h*) Some of the er girls should act as waitresses. They should be provided h clean washable aprons and sleeves, and should have als after the other children. (3) Young children and gety eaters should be given small helpings and encouraged eat what they don't like, and they can thus be taught to the same food as other children.

Meals in Rural Districts. Here often the problem is not verty, but distance from school to home, the object being to oid long journeys in the middle of the day and yet get nfortable and healthy meals. In many cases parents pay llingly. The School Medical Officer for *Devonshire* reports at there is prevailing ignorance as to suitable and economical d and cooking, and that often the food provided for ildren who stay to dinner at school is neither sufficient nor itable. Children stay to dinner in 540 departments, of ich 222 have some arrangements for supplying hot drinks, rming food, etc., but usually only in winter. The usual arge is a penny weekly per child, but in some cases hot nners are provided at one penny daily. In *Herts*, two ools supply penny dinners and some head teachers supply t cocoa, often at only one penny per week. In *Gloucester-re* local feeding centres exist in about twelve schools. *dfordshire* has a scheme for providing cocoa for children ying to dinner; it is self-supporting or assisted by local ds.

ondon School Feeding. The L.C.C. supplies breakfasts, ners and milk in the middle of the morning. All the rer cases get two meals, and in some cases cod liver oil an alternative to milk. Meals are provided on every day the week, by the Alexandra Trust, Cookery Centres, chen Centres and Private Caterers.

esults. The training in civilised manners is undoubtedly meating to the home, as parents often testify. Further, children are developing the habit of right feeding. Reform he home is being aimed at by *instruction to housewives* on foods which can be used as substitutes for meat and fish, food specially fit for children, economy in buying, cooking, etc., and the use of simple cooking apparatus with special regard to economy of fuel. The Board of Education gives grants to local authorities undertaking this work.

Rickets is essentially a disease of babyhood, and a good many babies die of it. The cause is wrong food, chiefly lack of fat, a lack existing in all patent foods. The disease begins with excessive perspiration and swelling of the abdomen, and the bones do not ossify properly. *After-results.* These are the worst feature of the disease, and by the time the child comes to school are all that remain of it. They include (1) stunted body ; (2) square, bony forehead ; (3) bow-legs and knock-knees ; (4) deformed spine (severe lateral curvature is often due to rickets) ; (5) rachitic chest, showing two grooves, one on each side of the breast-bone, owing to the softness of the bone making it unable to resist the external atmospheric pressure. This is always accompanied by deficient power of expanding the chest and by tendency to lung complaints ; (6) bony swellings on the ends of the bones, at points such as the elbow, knees, wrist and on the ends of the ribs, giving "rickety rosary," so-called because the lumps look like beads under the skin.

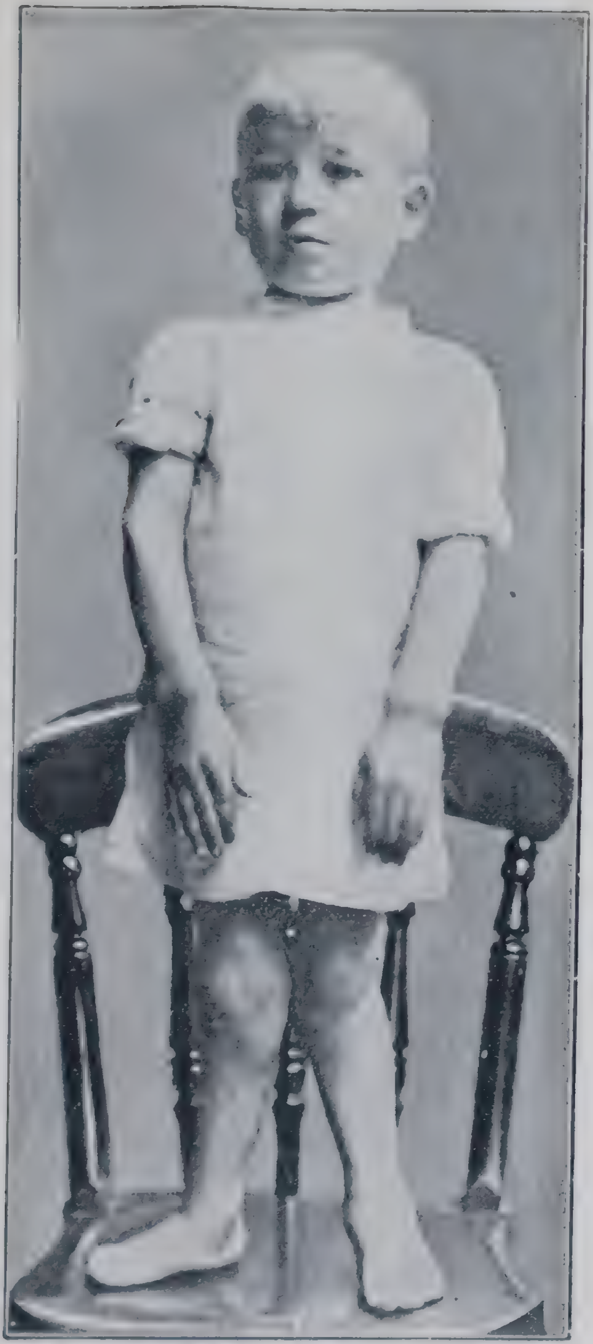

Fig. 43. Rickets. Note the deformity of the legs and the thickening of the wrists and ankles

(From Porter's *School Hygiene*. Longmans, Green and Co.)

CHAPTER VIII

THE EXCRETORY SYSTEM

Skin: uses, care of skin and hair—Skin-diseases: scald-head, scabies, ringworm, alopecia, pediculosis.—The kidneys.

The Excretory System. This consists of the skin, kidneys, lungs and large intestine or bowel, and its function is the getting rid of the waste matter formed whenever mental or physical work is done, and that which represents the undigestible part of the food.

The Skin consists of two layers—dermis and epidermis. The epidermis, or scarf-skin, is built of cells which become very much flattened at the surface and peel off, being replaced by new cells from beneath. The dermis, or true skin, contains *capillary blood-vessels*, the ends of the nerves of touch, coiled up into cocoon-shaped bundles called "*touch-corpuscles*," the *sweat glands*, which are coiled-up tubes opening by straight ducts on to the surface of the epidermis, and the *roots of the hairs*, which are formed by the dipping down of the epidermis into the dermis, so forming a socket in which the hair originates. Opening into each hair-socket are two little glands (sebaceous glands) which make an oily secretion (sebum) and pour it into the socket. The skin is flung into folds, which are most obvious on the palms of the hands and the soles of the feet.

Functions of the Skin. (1) To excrete sweat, a waste fluid, separated from the blood by the sweat-glands, and consisting of ninety-eight per cent water + two per cent solid. The solid consists of fat + organic acids + mineral salts (e.g. Sodium Chloride). This amounts to about one quart per day and is chiefly given off as *invisible* vapour. Active exercise and certain nervous conditions increase the amount so that it cannot evaporate as quickly as it is formed, and therefore appears as liquid *visible* sweat. (2) Other functions of the skin, apart from excretion, are important. Thus it is a *sense-organ*, since it contains the touch-bodies which receive impressions of touch, temperature, etc. (3) Also, it is one of the chief *regulators of body-temperature*, five-sixths of the heat given out by the body being lost in the form of latent heat needed to evaporate the sweat and in warming the air in contact with the skin, as explained in the chapter on Respiration.

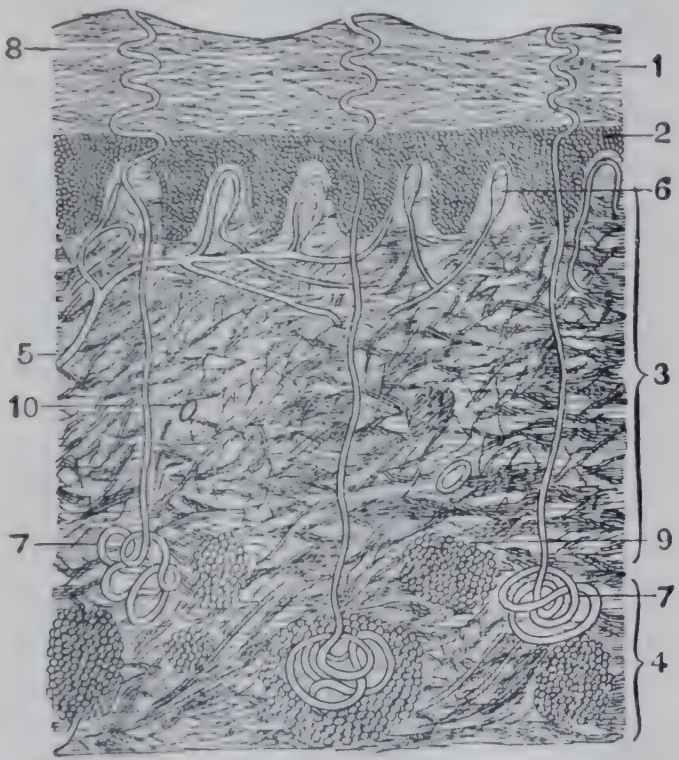

Fig. 44. Vertical section of the skin (diagrammatic)

1, epidermis; 2, malpighian layer of epidermis; 3, dermis; 4, subcutaneous tissue; 5, blood-vessels giving off loops into the papillæ of dermis; 6, touch corpuscle; 7, sweat gland; 8, duct of sweat gland; 9, cluster of fat cells; 10, cut end of blood-vessel

(From Thornton's *Elementary Practical Physiology*. Longmans, Green and Co.)

Care of Skin and Hair. If the skin be left unwashed it becomes covered with a layer of dirt, consisting of sebum, the horny surface-cells of the epidermis, the solid part of the sweat, and dust, germs, etc., trapped by the sticky, oily stuff on the skin. Decomposition sets in and we get the very objectionable odour of dirty skin ; skin-disease and parasites flourish ; the sweat-glands are blocked, so that the sweat is more or less prevented from escaping, and the skin becomes charged with waste matter. It therefore gets into an unhealthy state, develops pimples, blotches, etc., and extra work is flung on the other excretory organs, such as the kidneys, which try to get rid of the waste which should be eliminated by the skin. Heat-retention also follows, the results of which have already been discussed. Consequently, one needs to remedy this state of affairs in school by instruction in rules for the care of the skin, and by *practice* of those rules as far as the washing facilities in the school permit. This matter will be dealt with fully in Chapter X.

Indications of Health and Disease of Skin. A healthy skin is clear, smooth and firm. An unhealthy skin shows rashes, blotches, etc., and is very liable to disease. The commoner skin-diseases are :

1. **Scald-head or Contagious Impetigo or Infectious Eczema.** This consists of little blisters, first on the face, specially at the corners of mouth and chin, then spreading over the scalp, hands and arms. It is usually associated with vermin. After a few days, dry yellow scabs form. Children are infectious and therefore should be separated from others. They are often seen in school, plastered with ointment, which is quite useless unless the scabs are got off first. The right *treatment* is to poultice for half an hour with bread and linseed, then pick off the crust with clean rag over a basin of hot water, *then* put on white precipitate ointment, and the condition can be cured in twenty-four hours. Dr. Crowley calls this the most common form of skin-disease among children.

2. **Scabies or Itch** is due to a parasite, just visible to the naked eye, one-fiftieth of an inch long, which burrows into the skin, specially in the creases between the fingers and at the wrists, producing a track about one-eighth of an inch to one-quarter of an inch long, at the end of which she lays eggs. Hence black lines mark the burrows and little vesicles mark

the tops. The irritation makes the child scratch and so produce little sores and scabs. Itching is worst at night, when the skin is warm, for then the young parasites come out of the burrows and crawl about on the skin. It is *violently* contagious, spreading over the hand and often over the whole

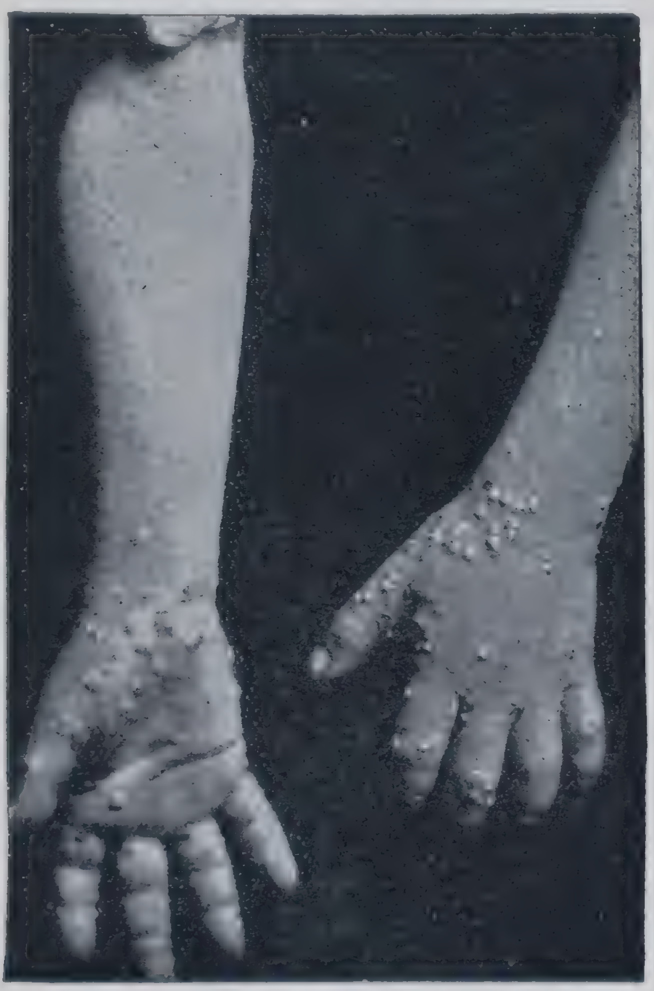

Fig. 45. Scabies

(From Drummond's *School Hygiene*. Edward Arnold)

ody, and to every person in the house, and into everything in he home. *Treatment*. A hot bath. Then rub all over with ulphur Ointment. Put clean sheets in the bed. Next day ut on clean clothes—sheets and clothes being boiled after se. All this should be repeated next night, and daily till the nsect is exterminated. It usually takes one month, and often ix or seven months if directions are not carefully carried out.

In 1916 there was a great increase in the number of cases of Itch in Elementary Schools, and this is attributed to contact with soldiers home on leave from France and elsewhere, and Dr. Adamson, Physician for Diseases of the Skin at St. Bartholomew's Hospital, gives the following treatment, which usually cures the patient in three days : (*a*) A hot bath lasting half an hour on three consecutive days. During the bath the body, especially hands, wrists and buttocks, are scrubbed with soft soap by a flesh brush. (*b*) After the bath, sulphur ointment is rubbed in, the patient puts on an old sleeping-suit, socks and gloves, and goes to bed till it is time for the next bath. The underclothes are washed and the outer garments brushed and aired.

Dr. Crowley says of Scabies, " The diagnosis is not always easy, and one not infrequently comes across cases being treated as eczema and which fail to get better until the real cause has been ascertained and the appropriate treatment used. Besides being mistaken for eczema it is also mistaken for Lichen urticatus, and cases of this complaint are wrongly labelled as scabies."

3. **Ringworm**. This is *not* a dirt-disease, like the preceding. It is due to a fungus attacking the scalp or the skin of the body, and the two types are distinct. (*a*) *Ringworm of the body* is the true ringworm. It occurs at *any age*, in *any place*, beginning as a spot which enlarges to the size of a shilling and then the centre heals and the outside spreads. The children should be excluded. It can be cured in three or four weeks by treatment with (sulphur + white precipitate) ointment. (*b*) *Ringworm of the head*—consists of a rough scaly patch of any size, up to one covering the whole head. It is not in a ring at all, but may be of any shape In ninety

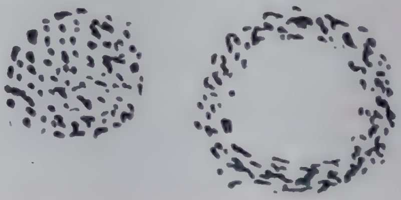

Fig. 46. Body ringworm

er cent of cases a *few* hairs are affected and break off short, ut the hair as a whole does not fall out, and therefore you nly notice the patch on *looking*. In Paris the average period f cure is twenty-five months, and five years is quite common, hilst cases may last ten or eleven years. It is typically a *isease of childhood*, never occurring in adults, and it is ommonest between five and seven years old. From the hool point of view its seriousness lies in the educational loss om long absence plus the fact that cases often return uncured and infect others. In Leeds (in 1915) 116,488 attendnces were lost through it, and in Ipswich 69 children lost ,650 days. *Treatment.* The only successful method is by -rays. These make the affected hair fall out, but it grows

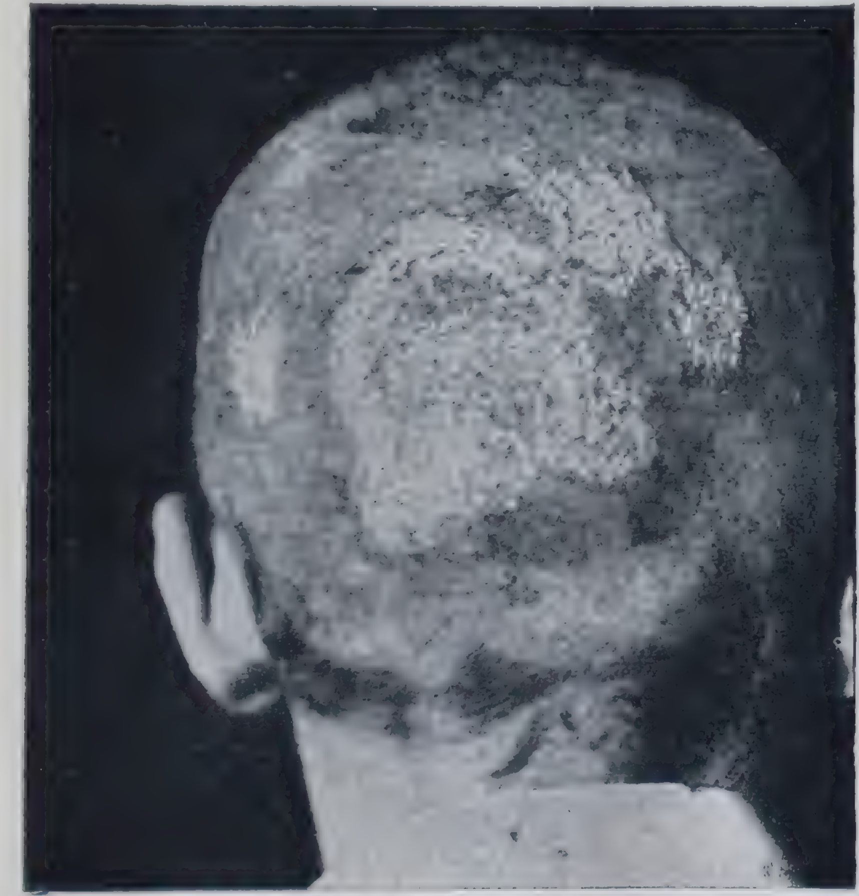

Fig. 47. Ringworm

(From Adamson's *Skin Affections in Childhood*
Oxford Medical Publications)

again; five or six years ago it didn't always grow again, because operators did not know the right strength and length of application of the Rays. All Education Authorities should provide X-ray treatment. In some places children are allowed to come to school with ringworm. If so, they should wear a cap or bonnet, should sit in separate desks, should either never wash in school or have a special towel kept in a special place, and should hang outdoor clothes in the caretaker's or some other room apart from the school cloakroom. Mothers often say that the child simply has scurf or dandruff, but this is *not so rough* as ringworm and *the scales rub off* more easily and it is *not in patches*, but all over the scalp.

4. **Alopecia** is fairly common in children and often mistaken for ringworm. It may be partial or total. The partial form is marked by a bare patch, coming suddenly on the head. The patch is quite *shiny* and so unlike ringworm. It is not infectious. In partial Alopecia the hair grows again, usually. In total Alopecia the hair does not grow again, usually.

5. **Pediculi or Lice.** This is much commoner among girls than boys. The Board of Education's Report for 1916 shows about twenty-five per cent of girls to have nits or lice present (usually the former). This is a condition which only head teachers can really deal with efficiently. Doctors and Nurses and the Law can only deal with the bad cases. Extraordinarily good results have been obtained in some very dirty schools by cleanliness campaigns conducted by an enthusiastic staff. "It is not, perhaps, sufficiently understood even yet how closely allied is uncleanliness to disease. For the child uncleanliness is disease, irritation and disablement. Infection follows it like a shadow, and maladies of the skin soon arise. Thus the child becomes a victim of dirt, its sleep is disturbed, and its education largely nullified."[1]

The *Head-louse* is a grey-coloured animal, hardly visible on the skin, the colour varying with race, to match the skin. Many more males than females exist, and each female lays fifty o one hundred eggs in its three or four weeks of life. It has a arp borer which pierces the skin and sharp claws with hich to cling to the hair. *Life-history.* The eggs are laid n the hair, as small brown specks and are cemented to the air very firmly, so that they point downwards. They are sually placed one inch or so from the roots. In examining head it is best to look under the hair, at the back. Owing to s downward direction the nits are not likely to come off

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[1] From the report of the Chief Medical Officer of the Board of Education, 1915.

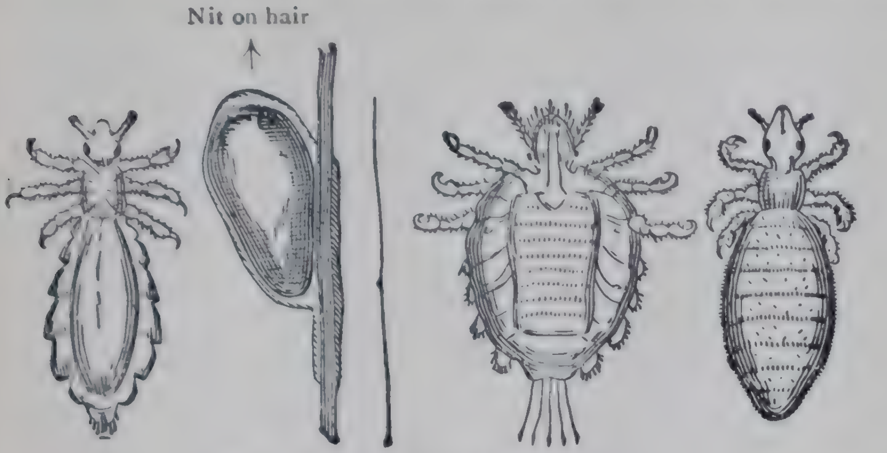

Fig. 48. Various kinds of lice

(From *Our Baby*, by Mrs. Langton Hewer. J. Wright and Sons, Bristol)

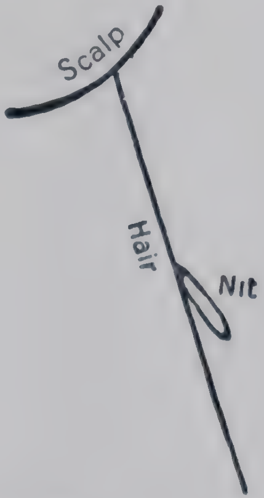

Fig. 49. Diagram showing how nit is fastened to hair

during ordinary brushing and combing. They hatch in six or eight days and the empty case then looks whitish. The female begins to lay when a fortnight old. She lives by blood-sucking, inserting a poison which makes the wound itch, and so the child scratches, and the result is sores which become caked over with scabs and sometimes spread to the face. This is the common cause and form of *Impetigo*. Also, the glands at the back of the neck are often poisoned, enlarge and may become tuberculous.

Treatment. (*a*) Nits only. (1) Cut away the hair with the nits. (2) Soak with warm vinegar for half an hour. (3) Then comb with a *fine* tooth-comb (penny ones are of no use). (4) Repeat nightly, till no nits are left—and it may take *many* nights. (*b*) *Lice.* Rub in a mixture of equal parts of petroleum and olive oil over night, tie up in a handkerchief, and shampoo with hot water and soft soap in the morning. Repeat for two or three days. Tooth-comb also.

The *Body-louse* leaves little pink spots, *closer* than flea-bites, and blood-specks on the clothes. Look for the spots on the upper part of the chest. The louse and eggs are found oftenest on the inner side of the clothes. *Treatment.* A hot bath, and clothes baked or boiled, or at least gone slowly over with a hot iron. Clean sheets—and everything must be *clean all at once.*

The Kidneys. These much resemble sheep's kidneys, with which most people are familiar. There are two in the body, placed high up towards the back of the abdomen. Each is full of branching, twisting tubes, all opening into one main tube, the *ureter*, which terminates low down in the front of the abdomen, in the bladder. (See page 72.) Further, the kidney is full of capillary blood-vessels, formed by the breaking up of the *renal artery* which brings blood to be purified in the kidney. These finally unite to form the *renal vein*, by which the blood leaves the kidney. The kidney glands separate a waste fluid, *urine*, from the blood and pass it down to the bladder. *Urine* consists of water + nitrogenous material and mineral salts dissolved in it. The nitrogenous stuff is called *urea* and *uric acid*. About three pounds or two and a half pints of urine are excreted aily, containing ninety-six per cent water and four per cent olid. Kidneys and skin between them get rid of most of the aste water of the body, and if one be very active, then the ther is not so active, and vice versa; e.g. in cold weather iere is less blood in the skin capillaries; therefore we excrete ss perspiration and *more* urine. *Stone* in kidneys or bladder, nd inflammation are fairly common in children and therere may cause frequent need for leaving the room. Inflamation of kidneys, leading to Bright's disease, may occur fter scarlet fever, and one should therefore be very careful avoid chills during convalescence, as a chill on this inflamation may have very serious results. *The work of Lungs and owels* have already been discussed (in Chapters V and VI).

CHAPTER IX

WARMTH AND CLOTHING

Nature of body-heat—Clothing (use, characteristics of good clothing, materials, choice of clothing for children, foot-gear, handkerchiefs).

In a cold climate, such as ours, the main object of clothing is to conserve the heat of the body. This heat is produced by chemical changes in the body, these changes consisting chiefly of oxidation of the food-substances taken into the blood, and so clothes have been said to be a substitute for food, and, indeed, if well-clothed one needs less food, and vice versa.

Points to be considered in regard to Clothing.

1. *Conductivity* for heat. This depends partly on the material and partly on its texture, air-interstices greatly decreasing conductivity, since air is a bad conductor. For the same reason several thin garments are warmer than one thick one of equal weight, because of the layers of air between the former. Wool is a bad conductor ; linen is a good conductor ; cotton is an intermediate conductor, cellular makes such as " Aertex " being much worse conductors than calico and hence much warmer, for a given weight of material. (2) *Clothing should be hygroscopic*, i.e. capable of absorbing water into its substance, and letting it evaporate off slowly. Wool is of this description, whilst calico is non-hygroscopic, and so perspiration condenses on its surface, evaporates *rapidly*, taking latent heat from the skin, and hence the skin is covered with a cold, wet, clammy material, and chills ensue. (3) Any material which is *waterproof* is bad because it stops evaporation, and hence causes heat-retention in the body, one of the surest ways of upsetting it, as already explained under Respiration (Chapter V). Most people know the discomfort

of taking active exercise in a mackintosh, and how when one takes it off one often finds the inside surface quite wet owing to condensation of sweat on it. (4) *Inflammability* should be considered, e.g. flannelette is cotton with nap produced on the surface, giving it nearly as great warmth as flannel, but it is highly inflammable, even the kinds sold as safe being nearly as bad after one or two washings as the rest. Hence, if parents cannot afford wool, they should be very careful that children dressed in flannelette night-gowns, etc., don't go near fires or flames of any kind. (5) The "*Make*" of the garment is important. It should be loose enough to allow the film of air in contact with the surface to move freely, and so help evaporation of sweat. Also, loose clothes are warmer, because the layers of air caught between them are non-conductors. Further, tight clothes compress muscles, hinder movement, circulation, respiration, etc.—and school children wear a surprising number of tight garments. (6) The *Weight* should be as little as possible, for heavy clothes are tiring. All weight should hang from the shoulders rather than from the hips. Hence the "Princess" style is better than two separate garments, and combinations are better than chemise and drawers. (7) Clothing should be *uniform* over the body. As a rule women have too many layers at the waist, and often children have far too little on the legs. Bare legs may cause much damage by helping on the latent rheumatism so common in children. (8) If possible, clothing should be of material which does not shrink in washing, but this is very hard to obtain in conjunction with the other desirable qualities, for wool is by far the best material for wearing next the skin in summer and winter in all respects except this—that it *does* shrink, owing to the loss of its natural oil during washing. Cotton, on the other hand, does not shrink.

Children's Rational Clothing. Boys are usually much more sensibly dressed than girls. The chief error in boys' dress is excess, e.g. three waistcoats or three jerseys under the coat are not uncommon.

Suitable clothing for quite a little boy, of four years old say, might consist of combinations, knickers buttoned on to a body (which does away with braces), and a tunic. The *material* of these garments should vary according to season. The *combinations* are best made of wool, thin in summer and thick in winter, but if of cotton, e.g. flannelette, cellular stuffs, etc., a woollen vest should be worn underneath in winter. Winter combinations should have long sleeves. The *knickers* might be of drill or casement cloth in summer and of serge in winter, but in this case they need a cotton detachable lining or at least a cotton lining for the seat. The *body* can be made of drill. The *tunic* can be of holland, casement cloth or woollen stuff.

For an older boy, say of ten, clothes might consist of shirt, drawers, jersey (instead of waistcoat), knickers and coat. In summer the jersey or coat might be discarded. The material for the underclothes should vary with the season, as described in the last paragraph, the remarks about combinations applying in this case to shirt and drawers.

A girl's clothes might consist of combinations, knickers buttoned on to a body, and a blouse and drill-tunic *or* a straight frock with loose belt, the materials again varying with weather as suggested above. *Combinations* are much better than chemise and drawers, but are not popular with poor parents, partly because they do not realise their advantages, and partly because it is rather hard to get a good pattern. If the winter combinations are woollen, a vest is unnecessary, but if of cotton, including flannelette, a vest is needed. The combination pattern given in Miss Synge's book makes a sleeping-suit also, if the legs be cut longer. *Skirts and dresses* should fasten in front, so that the child has no need to ask its mother to fasten them. The kimono pattern is simplest, and can be used for a frock, overall, pinafore, blouse or nightgown. *Nightgowns* can be of flannelette or twill calico. The latter is warmer than untwilled calico and also stronger. Wincey, aza, viyella and flannel are also suitable. The *actual* clothing of the elementary school girl is often very far from conforming to these suggestions. For instance, Miss M. B. Synge in her book *Simple Garments for Children*, says that they often wear a thick vest, a bunchy, flannelette chemise and drawers, stays, two or three petticoats gathered or pleated into a band, or fastened to one, two r three bodices, a bunchy frock and a pinafore. The garments re of different sizes, some too big and some too small, and bviously the child is overburdened and movement is ham-ered. Most teachers are only too familiar with this diffi-ulty in drill-lessons. The same book quotes from a recent eport on Liverpool children by Dr. Arkle, thus: “Large umbers were stitched into their clothes. They wore them ight and day. The air never got to their skins, many of hem wore far too many clothes.”

Foot-gear. It is important to realise that the shape of the oot alters when placed on the ground, because the toes pread out and the arch flattens, so making the foot longer nd wider. Hence the back of the boot should grip tight nd the front of the boot should be loose. To achieve this ve need the following conditions: (1) The boot should not neet when first laced up; (2) half an inch space between he toes and the end of the boot; (3) the toe well boxed-up, o allow for the spread of the foot; (4) the heel moderately ow, because if high, the line through the centre of gravity of he body falls far forward on the foot and this strains the igaments. People who say they *need* high heels usually ave weak insteps and need *instep-pads.* (5) The inside edge f the boot should be nearly straight. Most babies' shoes ave no “rights and lefts” and this is quite wrong. Shaped ight and left shoes (called the “Nature-formed” shoes) can e bought. *Connection between feet and respiratory system.* Wet feet mean chills, often leading to colds, bronchitis, ongestion of lungs, etc., and so predisposing to consumption. Hence the importance of stout foot-covering. *Stockings.* From the point of view of *cost* the home-knitted stocking is ar the cheaper in the long run. It is common now to buy he stockings which one can get for a few pence, wear them nto rags and then fling them away, with no mending. A ome-knitted stocking will give warmth, stand re-footing, and n the end be far the cheaper, as well as being a considerable afeguard against colds. Before the War, the wool for a pair or a ten year old child cost ninepence.

Aim in giving Lessons on Clothing. Whether these be iven in Needlework or in Hygiene period, to girls or mothers, one wants to teach them to dress healthily, so that the clothes help instead of hindering right bodily development. At the same time one wants to simplify the labour of making and washing and to lessen the amount and cost of material. Hence (1) one wants to do away with the old, heavy, pleated patterns and combine two garments into one wherever possible. (2) Again, one wants the habit of buying ready-made garments given up, because these things are so much less durable, for the same amount of money spent, than are home-made garments, and there is so much less labour in making the modern, hygienic, simple garments as compared with the old types, that if only one can get people to try them, there is hope of this reform being accomplished. In this connection, let me recommend the patterns accompanying each copy of Miss Synge's book, mentioned above. Other, though less important, points to remember are: (3) The desirability of pockets. I know one head mistress of a high school who sends girls home if they come to school without pockets. (4) The need of handkerchiefs in these pockets. Might not children make their own handkerchiefs in school, during handwork or sewing lessons? The disgusting state of many children, especially in winter, owing to lack of handkerchiefs, is too well known by all concerned in elementary school work. (5) Cheap trimmings of lace might be replaced by very simple embroidery, on the lines given in Miss Swanson's *Educational Needlecraft*—and so money could be saved and beauty gained. (6) One wants all children to possess nightgowns. In poor homes they often sleep naked or in their day clothes. (7) Might not white pinafores be replaced by coloured ones with advantage? Washing would be lessened—and often appearance improved. In France, every elementary schoolgirl wears a black overall with sleeves, and though this may look dismal, it is more becoming than a dirty white pinafore.

CHAPTER X

CLEANLINESS

Relation to health—What can be done in school—Baths—The school medical service—The Children Act.

We have now to consider the importance of cleanliness to the individual, the school, and the home, and how it may be achieved. The importance of the matter was alluded to in Chapter VIII, and statistics prove that the health of people living under similar conditions is highly dependent on personal habits.

With regard to school children's habits, the teacher (1) should demand clean hands and faces as the first step, and should see that the children *do* use the washing facilities provided in school. Only a week or two ago a friend of mine went into a boys' class where many of the boys were sitting idle because they had dirty hands and so the teacher wouldn't let them do their work. Why weren't they sent to wash? My own experience is that there are none too many basins in school lavatories, and hardly ever more than two towels, put clean once a week, when there should be one towel per basin, put clean daily, but what is most irritating is that so many schools seem to regard the basins as ornamental only. Soap is non-existent, the reason given being usually that children steal it. Now, that may be so, but the remedy surely is to get a proper supply and watch it, if necessary. In the handbook issued by the *Committee on the Health of Munition Workers* there are some suggestions which are very applicable to school conditions; e.g. (*a*) hot water as well as cold in lavatory basins. (*b*) Nail brushes. These can be large and fixed, to stop theft, the hand being rubbed on the brush, *or* the brush can be chained. (*c*) Soap can be supplied "soft," in small, locked boxes above the basins, with a hole in the top, through which a finger can be inserted and so the soap scooped out. Soap can be bought as powder, which sets to a jelly on the addition of water, from Lever Bros., Port Sunlight, Cheshire. This lessens the cost of carriage. *Or* the powder can be put in a dredger chained to the trough or basin. A teacher or other supervisor should be on cloak-room duty at play-time and before and after school, whilst children are coming and going, in order to teach children, especially infants, how to wash, e.g. not to wipe off all the dirt in the towels. Further, a competent person should be in charge of the closets and should see that they are used properly, and that children needing help get it. (2) Hair brushed is another demand that the teacher can legitimately make, and she should do her best to get girls to wear it plaited or short, as there is then much less risk of vermin. (3) She should do her best to impress on parents and children the need of a weekly warm bath, including hair, and of weekly clean underclothes. The home-bath, however, is a great difficulty in families living in perhaps one or two rooms, with no kitchen-range or boiler, and more and more opinion is growing to favour the undertaking of the bath by the school, and a good many schools have bath installations, especially the " open air " and other " special " schools, though England is a good deal behind Continental countries in this provision of baths.

A few **School Swimming Baths** have existed for some time, and elementary schools often make arrangements with public swimming baths whereby classes can have the use of the baths at special times ; e.g. good school swimming baths may be seen at Bradford, where they are attached to a school, but serve as centres for neighbouring schools. The children go to the baths in batches of twenty to thirty. Dr. Crowley, in his *Hygiene of School Life*, says that the following points should be attended to :—

1. There should be a dressing-box per child.
2. Each child should wash under a shower before entering, or, *at least*, the feet should be washed in a trough provided for this purpose.

3. No children should be allowed to stand shivering on the edge, and definite instruction in swimming, diving, etc., should be given.

4. After coming out, each child should have a short, quick, cold shower, and then rub down and dress quickly.

5. Girls should wear caps, and if the hair get wet, it should be carefully dried.

6. A brisk run round the playground should be taken after the bath, if weather permit.

7. A teacher should accompany each group.

8. There should be a bath-attendant.

9. *Objections* may come from parents or children, though chiefly from the former, who are given, for example, to putting down every little cold the child catches to the account of the swimming—and there may be some ground for this if children come back cold, and not properly dried or dressed.

A swimming bath may be looked on as giving excellent *physical exercise*, but not as a cleansing agent, directly, at any rate. *Indirectly* it may so act, in virtue of the fact that one can train children to feel ashamed of exhibiting dirty bodies in public, and so may educate them into washing before they use the swimming bath. At present, however, the filthy state of the water in many of our public baths testifies to the fact that the users treat them as a cleansing agent. All sorts of devices have been introduced for remedying this state of affairs, e.g. blowing the scum off the surface, dragging the scum off the surface, adding disinfectant to the water, and so on; but the remedy is to have shower baths and soap provided in the same building and to insist on dirty children washing before going into the swimming bath. The best temperature is 70° F. A child should not go into a swimming bath till two hours after a meal, nor if cold or exhausted. No child should be allowed in if he or she is cold and numb for long after the bath. Children tend to stay in too long, and time must therefore be checked.

Shower Baths. These are the best kind of bath from the cleansing point of view, and this is the type that one is *particularly* anxious to see installed in the elementary schools. The swimming bath is desirable, but comparatively a luxury.

The shower bath is preferable to any form of tub bath because (1) no time need be spent in filling and emptying, (2) there is no risk of contagion, (3) it uses less water than any other pattern, (4) there is no cleaning out, etc., to occupy the caretaker's time. The water is sometimes controlled by the child and sometimes by the attendant. The temperature is variable in some cases, beginning warm and ending cold; in other cases it is wholly warm, but in any case the temperature is controlled by the attendant. In America some schools have very fine shower baths. It is desirable to have considerably more dressing-closets than baths, since this very greatly quickens the rate at which the children can bath; e.g. it is found that with ten baths and thirty dressing-closets, one hundred and twenty-five children can bath daily, each taking three minutes under the bath. A bath period is allotted to each class. In old-established schools, a central group can be made to serve several schools.

Results of Baths: (1) Better health, especially in the matter of skin disease; (2) therefore better attendance; (3) therefore better intellectual results from school work; (4) pleasanter atmosphere in class-room; (5) increased self-respect; (6) a good influence on the home, showing itself in cleaner clothing, for example; (7) the formation of a lifelong habit of cleanliness.

In one school in Chicago a tub and wash-bowl with hot and cold water has been fitted up in one small room. Soap and towels are provided. If the child comes to school dirty, the parent is sent for, the child's condition discussed and she is then asked to wash the child on the spot. Thus the parent gets an object-lesson in cleanliness, and the effect on the homes is said to be excellent.

Lessons and Inspections. In addition to the actual washing of dirty children, the school can give set lessons on cleanliness, and in this connection all girls should be taught exactly what to do to get rid of vermin. A good many teachers are shy about the matter, but there is no need, if the instruction be given naturally and simply, putting it in the light that *anyone*, however clean, may have the ill-luck to pick up vermin from dirty people and that then one ought to know what to do.

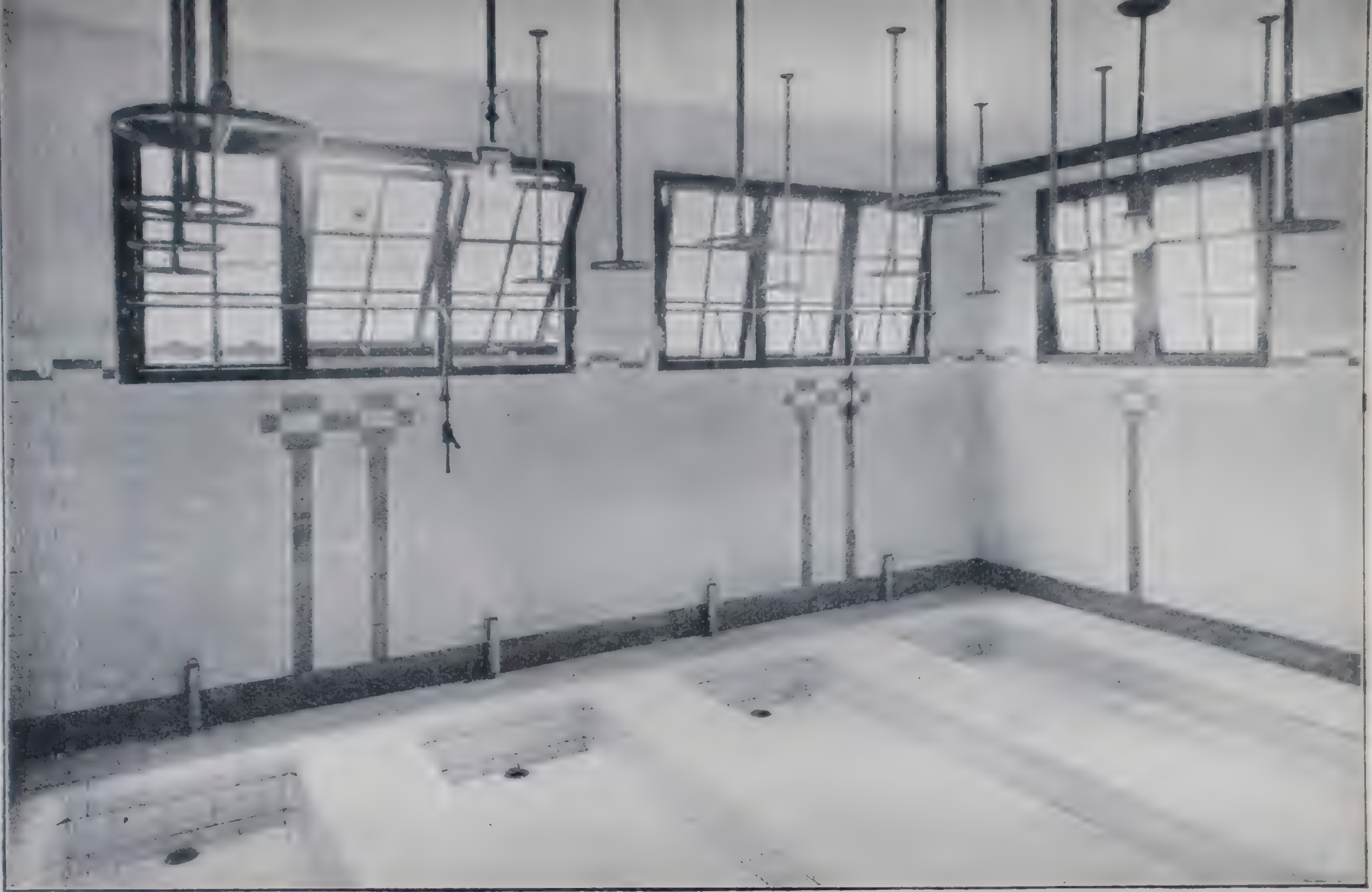

Fig. 50. Shower baths at a Bradford Public Elementary School

(From Crowley's *Hygiene of School Life*. C. W Hutt. Methuen)

The staff can also do a great deal by systematic inspection and by enthusiasm for cleanliness. In this connection I should like to describe the procedure at one school where the results achieved have been so excellent that the method adopted was described in the Report of the Chief Medical Officer of the Board of Education for 1913. The school is the Hughes Fields Girls' Council School, Greenwich, in a very poor part of Deptford, and at one time the condition of the children was so trying to the teachers that the latter were constantly absent through illness, supply teachers refused to stay more than a few days and the attendance was often so low as sixty to seventy per cent for the year. Then a new regime was instituted, the keynote of which was the teaching of hygienic habits by constant supervision and by making all the Hygiene lessons practical in character. (*a*) The two top classes get two Hygiene lessons per week. A lesson lasts half an hour and always contains some practical demonstration such as washing and dressing a doll, preparing a baby's food, or cleaning the house. These lessons are *repeated* till nearly every girl has had the chance of using the simple apparatus employed. Younger girls have occasional health talks but no set lessons.

(*b*) *Inspection by the Staff.* The head mistress stands on the stairs as the children come up at each session and any seen to be dirty or with unbrushed hair are either sent home, or to the lavatory, after registration. Directly after registration, the head mistress goes to the lavatory with a monitress and superintends the use of the basins and towels, seeing that they are left clean and neat. Hence she goes to the cloakroom, and if any untidy or really dirty hats and coats are there, they are dealt with. Next comes class-room inspection, i.e. seeing that windows are open and everything clean. Twice a week the sanitary conveniences are fully inspected by the head mistress. The *staff* undertake (1) daily hair-inspection, by making all girls stand with backs towards the teacher, who passes down between the desks, looking at each child. The hair must show signs of having been brushed and combed and must be plaited ; if any have nits, they are sent to the lavatory under the charge of a senior girl, and sometimes the head mistress goes herself. This recurs daily till satisfactory results are obtained. (2) *Hand-inspection.* This is taken before each writing-lesson; on the command "hand-inspection," hands are placed on desks and then as the teacher passes down they are reversed, and if unsatisfactory a basin with soap and towel have to be used in the class-room, as the penalty, before the other children. (3) Every week enquiry is made as to who has slept with open window, and the few who do not do so, after the third or fourth enquiry, are talked to separately by the teacher. (4) The time at which each child went to bed is enquired into weekly. (5) Boot, stocking and handkerchief inspection is taken before each drill-lesson. (6) Tooth inspection occurs weekly, in connection with tooth-brush drill, and once a term each child brings to school the rag or brush she uses.

(*c*) *Practical work done by the children* can be divided into (a) Monitorial work, which is worked out so that each gets a turn; (b) Hygienic drill. (1) Thursdays, tooth-brush drill for juniors; Friday for seniors, acted in dumb-show with an imaginary piece of rag or brush, imaginary water, soap, cup and basin. Conducted thus: "*Ready*"—children stand. "*Fill your cups*"—this acted, with left hand for cup. "*Take your rag.*" Imaginary piece wrapped round first finger of right hand. "*Dip your rag.*" "*Now take a little soap,*" and action of rubbing rag on soap is done. "*Now clean outside the teeth,*" and the finger makes the movements just outside the cheek. "*Now wet the rag.*" "*Now take a little more soap.*" "*Now clean the crowns,*" and then follows the inside. "*Now wash and squeeze the rag.*" "*Now throw the water away.*" "*Now take some fresh water.*" "*Now rinse the mouth.*" "*Now put rag and cup away.*" This is followed by enquiry as to those who have carried this out. (2) Once a week *nail-trimming drill* is taken in the upper standards; paper is put on the desk and the girls bring scissors if possible. (3) *Handkerchief drill* is taken before each drill-lesson—when each girl holds up her handkerchief by its corners. Squares of linen are provided in special cases. (4) In addition, children do or see certain "extras"—e.g. each makes, usually from list, a pair of slippers for use in Physical Exercise lessons, and it has been found to almost abolish holes in stockings. Sometimes a model mother brings her baby to school and baths it.

Results. Attendance now averages ninety-two per cent. The staff is no longer absent frequently on sick leave, or wanting to get fresh posts. The children bear the closest inspection and make normal progress. Taking the school as a whole, the effect is well seen in passing from the lowest to the highest class. The lowest starts with dirty teeth, bitten nails, unkempt hair and untidy clothes, whereas the highest has clean teeth, properly kept hands and hair and neatly mended clothes. The happy and healthy look of the children make it hard to believe that this is a school of "special difficulty." The children obviously love the school and teachers no longer avoid it.

The above is only a sample of the work that can be done and *is* done in many schools, but one cannot rely entirely on the teachers to remedy uncleanliness. The other agencies are the School Medical Service, including school doctor, nurse and clinic, and the Law, embodied in the *Education Act*, 1921, and the Attendance Bye-laws. Most authorities who have employed school nurses use them, more or less, for detecting and following up verminous children. They should aim not only at securing cleanliness, but at *maintaining* it by frequent visits and re-examination. Again, it is of no use to rely on routine inspection of certain age-groups for the improvement of uncleanliness. Special inspection twice a year of every child and prompt following-up are needed. "The 'surprise' surveys by the nurses are often of more value in discovering the real extent of the condition than are the visits by the Medical Officer for routine inspection. The actual cleansing is carried out by the school nurse in the schools, at the home, at the school clinic, or at a cleansing station." (Report for 1914 of the Chief Medical Officer of the Board of Education.) In London, a very complete cleansing scheme exists, which has served as a model to other authorities. There are twenty-four cleansing stations, each serving an area of approximately one mile radius, and 41,458 cleansings took place at them in 1913, and 42,557 in 1914. Twenty of these also deal with scabies or itch. These stations are part of the "medical treatment " of children and provide facilities for cleansing heads and bodies and disinfecting clothes. Sometimes the Sanitary Authority provides them, or, if not, the Education Authority sometimes provides them in the school clinics, or elsewhere.

The Education Act, 1921, *sections* 87 *and* 89. Section 87 gives a local Education Authority power to examine any child attending an Elementary School, and if the child be filthy or verminous, to require the parent to cleanse its body and clothing within twenty-four hours. If the parent does not comply, the Authority may have the child cleansed, and if, after this has been done, the child again becomes verminous or filthy, the parent is liable to a fine not exceeding ten shillings.

Section 89 gives a Local Authority power to prosecute (under the Children Act of 1908) any persons who persistently neglect their children.

During 1930, in England and Wales, 700,000 school-children were found to be unclean and there were 488 prosecutions under this Act.

The Attendance Bye-laws also enable a Local Education Authority to prosecute a parent if a child has to be excluded from school owing to its dirty or verminous condition and the parent does not promptly cleanse it. Proceedings are taken on the ground of non-attendance at school. In 1930 there were 581 such prosecutions.

The National Society for Prevention of Cruelty to Children assists some Authorities by prosecuting cases of neglect reported to the Society.

An important lever in impressing on parents the need for cleanliness is the fact that the state of the head is one of the points to which the certifying factory surgeon is directed to attend in giving a certificate of fitness for employment in a factory.

Results. It is nowadays rare to find the gross states of uncleanliness which were common when medical inspection began, and thanks to all the agencies at work the improvement is great enough to justify Sir G. Newman in speaking of it in his 1930 report as "a revolution in cleanliness and dress,"—but much still remains to be done.

CHAPTER XI

THE NERVOUS SYSTEM

General function and structure of brain, spinal cord and nerves—Reflex action—Development of the nervous system—Centres for speech and writing—Word-deafness—Word-blindness—Characteristics of child's nervous system—Sleep.

General Function. To govern and control the whole body and mind, so that all parts work harmoniously with one another.

Structure. The Nervous System consists of three parts: Brain, Spinal Cord and Nerves. These, like all other parts of the body, are built up of cells, and though these cells are highly specialised, they live in the same way as do all other cells, i.e. they absorb oxygen and food, build up new tissue, excrete waste, and their health depends on the circulation and quality of the blood, which again depends largely on good food and fresh air. Hence these factors largely influence mental power and state of mind. The chief difference between nerve-cells and other cells is the elongation of the protoplasm of the former into many short branching fibres, and one longer fibre. The short ones are called *dendrites*, and though they do not actually fuse with those from neighbouring cells, they lie in very close contact with them and probably serve to transmit nervous energy from cell to cell, to some extent. The single, longer fibre is called a *nerve-fibre* or axon, and it is covered with a sheath of white fat which insulates it from other fibres. It has a few lateral branches, and both it and its branches end in tiny bunches of fibrils in the muscles or some sense organ. What we call a *nerve* is a bundle of such fibres, held together by connective tissue. Some nerve-fibres are very long—others are very short. Nerve-cells are grey in colour. In the brain, the outer part is grey, because built up of cells, and the inner part white, because built of fibres, running from cell to cell, or from cells to spinal cord, etc. In the spinal cord the colours are reversed, because the cells are inside and the fibres outside.

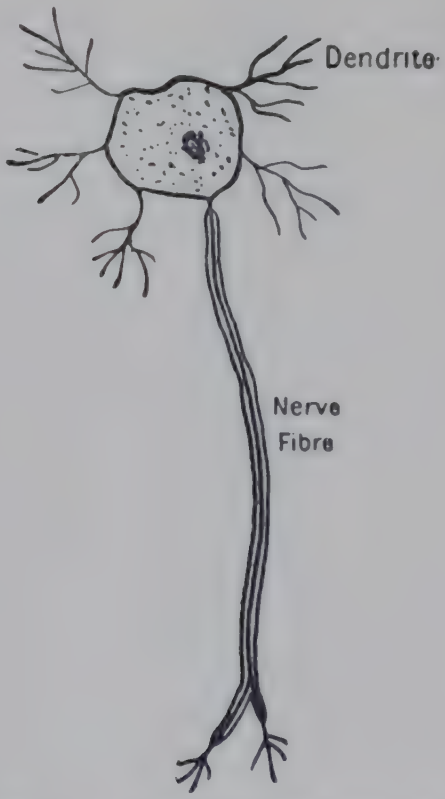

Fig. 51. Diagram of nerve-cell

Functions of Nerve-cells and Fibres. The cells are makers and storers of energy, which they use in two ways: (1) They may receive nervous impulses travelling inwards along their fibres from muscles or sense-organs and translate these into conscious sensations. These are therefore called *Sensory Cells*. (2) They may send out nervous energy, or impulses, along their fibres to the muscles or glands; these cells are therefore called *motor*. The function of the nerve is to transmit energy, just as a telegraph wire transmits electricity. If it conveys energy to a nerve-cell it is called *afferent* (Lat. *a*=to ; *fero*=I carry) or sensory. If it conveys energy *from* a nerve-cell it is called *efferent* or motor. Certain nerve-fibres serve to connect different nerve-cells in the brain, and are therefore called *association-fibres*, or intercalary fibres, and by virtue of these and the dendrites, stimuli can pass from one cell to another, i.e. conditions affecting one part of the body may, through a chain of connecting nerves and cells, produce responses in other parts. Thus a pin-prick or an unpleasant object seen or tasted, or a sound heard, may all cause the same muscle to contract, e.g. those of the face, causing a grimace, i.e. a group of motor nerve-cells controlling certain muscles can be excited from several sensory centres. Conversely, a stimulus passing inwards along one sensory nerve may spread itself out over several motor nerve-centres, e.g. a pin-prick may result in a cry, a grimace, and a sharp withdrawal of the finger pricked.

The Brain is enclosed by the skull, and is covered by three membranes : the dura mater, the arachnoid and the pia mater. The pia mater brings blood to the brain, and between it and the middle membrane is fluid, acting as a buffer to protect the brain from jarring against the skull. The brain has three divisions : *Cerebrum, Cerebellum* and *Medulla.* Its surface is flung into folds and ridges called *convolutions*, these being deeper and finer in the cerebellum. They are due to our mental growth, to knowledge gained, etc., and therefore the value of a brain depends on the number of its convolutions. There are few in children, idiots and savages, and none in the lower animals, such as reptiles.

Functions of the Cerebrum. This is the part of the brain concerned with all the higher mental processes, such as thought, imagination, memory, will. It contains motor and sensory areas corresponding to and controlling every conscious activity, including those of the special senses (of Sight, Hearing, Tasting, Feeling, Smelling). Some of these centres have been located ; others have not yet been " placed." The cerebrum can also control (or inhibit) wholly or partly the action of the centres in the spinal cord. We will return to this matter later. Since the cerebrum is the organ of consciousness, any accident to it means partial or total unconsciousness.

Functions of the Cerebellum. To control the balance of the body and keep it in the correct attitudes. It works automatically, i.e. involuntarily, though in cases of great difficulty, such as tight rope walking, the conscious brain may help. The *ear* plays a special part here. The semicircular canals in the ear contain fluid in which hang the ends of nerves running to the cerebellum, and not concerned with hearing, but only with balance ; e.g. if these canals are injured we become giddy.

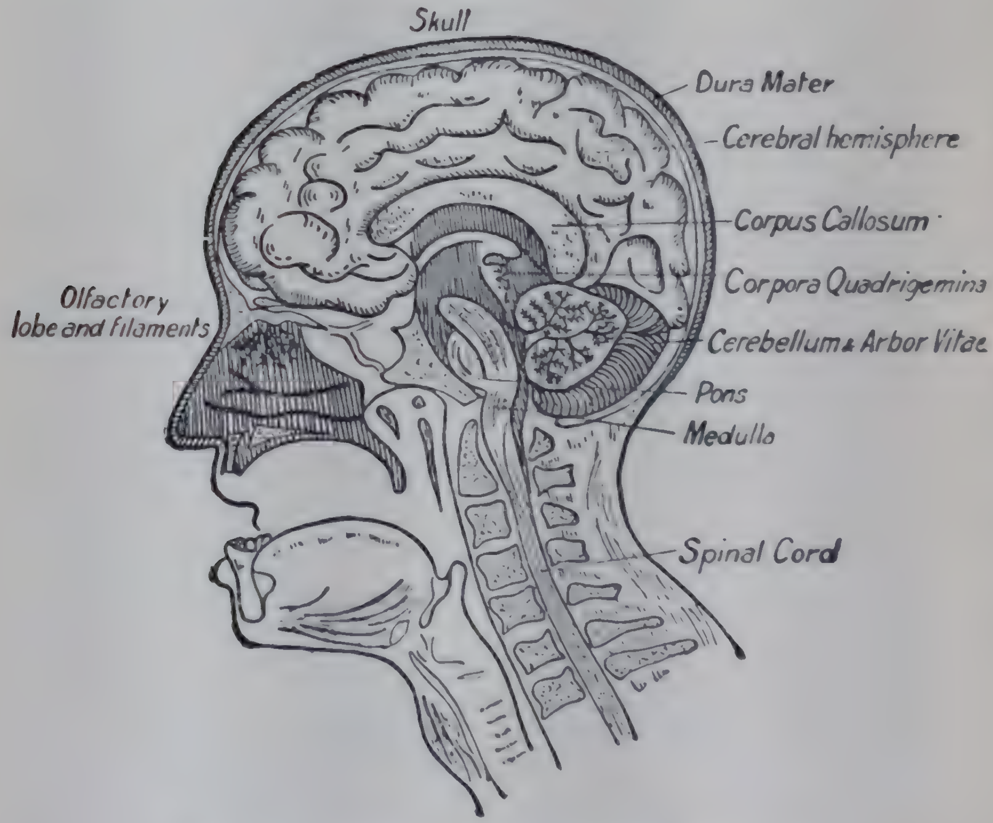
Skull
Dura Mater
Cerebral hemisphere
Corpus Callosum
Corpora Quadrigemina
Olfactory lobe and filaments
Cerebellum & Arbor Vitae
Pons
Medulla
Spinal Cord

Fig. 52. Section of head, showing brain, etc.

Functions of the Medulla. To control the organic life-processes. It is connected by nerves (the tenth pair of cranial nerves, i.e. the vagus nerves) with all the blood-vessels and internal organs. It is not controlled by the cerebrum, with the exception of one centre, the breathing centre, which can be partly inhibited. However, there is some sort of connection with the cerebrum, for conscious states of emotion, etc., do affect the beating of the heart, circulation, breathing, etc. Injury to the medulla probably means death.

The control of organic functions is also partly effected by the *Sympathetic Nervous System,* consisting of two grey cords lying in front of the backbone and giving off nerves which join the spinal nerves and form a complicated network running to the internal organs.

Structure and Functions of the Spinal Cord. Here, as in the brain, the cells are grouped into motor and sensory

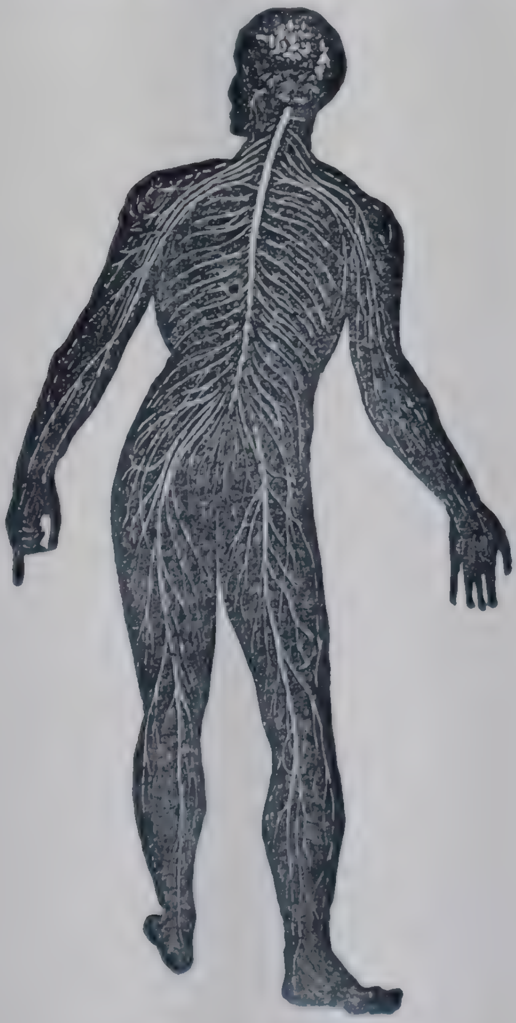

Fig. 53. Nerves

(From Jewett's *Control of Body and Mind.* Ginn and Co.)

centres, and they give off fibres which constitute thirty-one pairs of "spinal" nerves. They give off other fibres which run up the cord to the cerebrum. Hence, though the spinal centres govern the movements of practically all muscles except those of the head, yet they are themselves ruled, more or less, by the higher centres in the brain. Consequently, an impulse entering the cord by a sensory nerve may stimulate (1) the cord centre; (2) higher centres, and so we get *Inhibition*, e.g. if you tread on a tin-tack your first impulse is to jerk your foot away, but you can restrain this impulse by the exercise of will-power. Similarly one can restrain, or inhibit, coughing, blinking, fidgeting, etc., and good manners largely consist in the exercise of this inhibitory power of the conscious brain over instinctive actions. In some people the connections between the brain and cord are poorly developed, and then the control of the conscious brain over

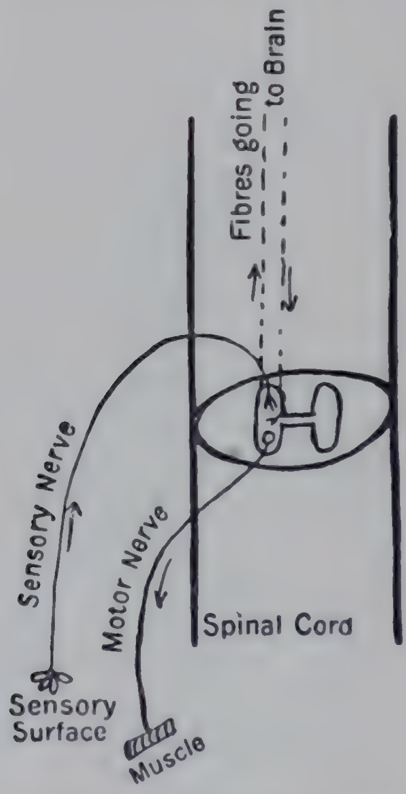

Fig. 54. Diagram illustrating reflex action

(Adapted from Thornton's *Elementary Practical Physiology*) the cord decreases or ceases. In other cases, e.g. sleep, the conscious brain is out of action and so cannot control the cord; e.g. tickle the soles of a *sleeping* person, and the leg is jerked up unconsciously. When *awake*, the person can, if he likes, resist the desire to jerk his foot away.

Reflex Action. Actions performed solely on the initiative of the cord are involuntary and are called simple reflex actions. Not all reflexes are as simple as the one described above; e.g. swimming involves concerted action of many groups of muscles, and this co-ordination is *learned*, not instinctive, and hence this class of reflexes is often called *habitual or acquired.* When learned, these actions do not need conscious thought, but are controlled solely by the cord, but during the learning process they *do* involve thought and therefore are not reflex. The explanation of the change is that constant repetition of an action wears a path in the cord, and finally the impulses cease to go to the brain and so the action becomes a *habit.* Habits have been defined as the *memory of the lower centres.* They differ from *instincts* in that the latter are "born," whilst the former are "made," but instinctive actions are, of course, reflex, e.g. sucking in a baby.

Development of the Nervous System. Like all other parts of the body, the Nervous System is imperfect at birth in size, weight and power. All the cells are present, but many have no dendrites or fibres and are therefore incapable of work. Increase in size and weight is some indication of increase in power, but the increases are not proportional. Thus maximum weight is attained at fifteen years old, but certainly not full power. In general, however, there is a connection between size of brain and intellectuality, e.g. an idiot brain is always light and nearly always very small, never weighing more than 23 oz. in an "out-and-out" idiot, whereas the average weight of a normal brain is 50 oz. An anthropoid ape has one-third the brain-weight of man. Civilised races have larger and heavier brains than uncivilised peoples. A skull which is less than eighteen inches in circumference above the ears usually indicates mental defect, the normal size being twenty-one inches or more, from eight years old. The increase in weight and convolutions is specially rapid up to seven years old, and probably the Jesuits are right in saying that given a child till seven years old, you can do what you like to it after. Brain power develops rapidly up to twenty-five years of age, and at a slower rate up to forty, i.e. development goes on longer than in any other part of the body. What happens after forty depends, I believe, on how the brain is used. Its power may go on increasing, or may become stationary, or may slowly decrease. It certainly *will* decrease if the mind be allowed to stagnate.

The increase is due to the growth of nerve-fibres which gives increased control over body and mind. Where these fibres are rudimentary or non-existent, control is impossible; where they are only partly developed, activities are clumsy and awkward; it is only where they form definite, fixed connections that activities go on easily and quickly.

Like all other parts of the body the Nervous System depends for its health and growth on observance of the general conditions for healthy living, viz. on good nutrition, fresh air, sufficient warmth, cleanliness, exercise of both body and mind, followed by sufficient rest—but there are some further points involved. (1) For instance, it is important for the teacher to remember that the centres do not all begin to develop simultaneously; each has its own natural period of development. Some are almost perfect at birth, e.g. those governing vital actions, such as breathing, digestion, etc. Others lie dormant for years, and then may develop quickly or slowly. The result is that the child exhibits a series of spontaneous impulses to do different things, a series of spontaneous interests in various objects and subjects, and these instinctive tendencies appear at different periods. You will get the clearest exhibition of the child's instincts by watching him at play, for in play he shows all his interests, likes, dislikes, characteristics and powers, and it is an essential of good education to watch for the emergence of these instincts and to provide for their right guidance, for associated with every natural tendency is a great stream of energy needing outlet, and if we suppress this energy it may flow into wrong channels, with results disastrous to mental health—producing morbidities, neuroses such as hysteria, sexual abnormalities, etc., in later life. Hence we must provide an outlet for this energy, but not necessarily along the lines which it would take if the child were simply left to himself. Take, for instance, the pugnacious or fighting instinct which becomes so marked at a certain age in a boy. We cannot always allow this instinct to express itself in its primary form, since to do so would mean moral injury to the owner and possibly to his antagonist, especially if smaller and weaker—but we can sublimate the boy's pugnacity, i.e. turn it from selfish aims to battle for the honour of his side, team or house in organised games, and when he reaches adolescence we can provide further outlet by taking good care that he knows how much the world needs fighters in the great war of Right against Wrong. This is the age at which his interests naturally widen out to include "a world lying beyond the limits of the immediate surroundings"; hence now he is far more able to respond to that world's call for "service that gives meaning to life, that sweeps a person out of himself and makes him one with the purpose of God, for whom he vaguely longs." It is our business to give him chances of serving; we shall thus be doing our best to save him from selfish individualism and over-introspection and to turn him into a good citizen of the world.

Again, the instinct of curiosity becomes pronounced at a very early age; the little child, almost as soon as it can talk, begins to ask questions about everything and anything, and to investigate everything it can lay hands on. This stage is undoubtedly somewhat trying for the adult in charge, but the right way of dealing with it is to provide plenty of objects and materials on which the child can try its experiments without doing any harm, so gaining very valuable practical experience—and to answer its questions truthfully, as far as the child can grasp the matter, and in words which it can understand. Do not put it off with untruths, for the tiny child has a remarkable power of detecting untruth, and its confidence in the reliability of grown-ups will thereby be shaken, and this is undesirable in the extreme, especially where parents are concerned. We want the child to come to the parents for guidance about all the great things of life ; hence its belief in the parents should not be shaken, or it will turn to other and often less desirable sources of information. Take, for example, the questions which almost all little children ask about where the new baby came from. The old false answers about storks and doctors never satisfy or deceive it, and it turns to servants or school-fellows or others far less fit to answer its questions than the parents should be, and too often it gets the required information in a false and incomplete and distorted shape which affects its attitude towards the facts of reproduction throughout life. Thus, it is bound to conclude that sex and reproduction are somehow disgraceful—and so we let a matter which should be clothed with high ideals and spiritual beauty go dressed in the rags of vulgarity and untruth, and we need only look at the world as it is to see the harm thus done.

Again, the social instinct, when it appears, should be allowed expression by giving plenty of opportunities o healthy friendships between boys and girls ; if repressed we run the risk of making a morbid, introspective, socially useless individual.

Thus a large part of mental hygiene consists in providing abundant scope for outlet of instinctive energies, through games, hobbies, friendships, social service, etc. As Mr Edmond Holmes says, in *What is and What Migh Be:* "The victim of a repressive, growth-arresting type o education, having few if any interests in life, not infrequently takes to the meretricious excitements of sensuality in order to relieve the intolerable monotony of his days But the training which makes for many-sided growth, by filling the life of the adolescent with many and varied interests removes temptations of this type." On the other hand, we must avoid the pitfall of trying to "force" development. It is harmful to try to educate a centre before its natural perio of growth has been reached, e.g. one may set children to do fine work before their hands or eyes are ready, and so they are clumsy and awkward at it ; thus permanent damage may be done to the Nervous System and the general health and development of brain and body may suffer in consequence. Again, a mother may begin to teach the child to walk and talk too early, i.e. before he has shown that he wants to learn. Yet training can be put off too long, for skill cannot be acquired easily when the natural period of growth is over: this is the reason for the demand that the education in speech of the deaf and dumb should begin before seven, the age fixed by present regulations.

(2) Another important factor in mental development is *Example.* The child imitates with great ease and accuracy, and the first patterns are the parents; the child longs to be grown-up and it thinks that to do as father and mother do is the shortest cut to the desired end. Later it imitates other people with whom it comes in contact in real life, in books, in cinemas, etc. Hence the need that parents and teachers should walk warily, knowing that inevitably they will stamp the child with some likeness to themselves, and further that they should give him what is worth while in literature, art and amusement.

(3) Another factor in mental development is the formation of good *habits.* The nature of habit has already been described in connection with Reflex action. The essential points to grasp are: (1) That when a habit is once fixed intelligence is only needed to start the movement, which then proceeds automatically, with the result that the intelligence is left free to deal with more complex matters; and this is of great value, for, as one writer puts it, "If everything we did and thought were as difficult as the first time we practised it, mankind would have made no progress from the lowest savagery." (2) That a habit is much easier to make than to break. Hence the more good habits we can teach the child the better for its mental growth—but the bad habit may cause much suffering either to the victim or to those around him.

Development of Centres for Speech and Writing. These are of special interest to the teacher and so may be discussed in rather more detail. The four centres involved are subdepartments of four larger centres on the left side of the brain, except in left handed people. The four larger centres are the Auditory and Visual centres (sensory) and the centres for the right arm and for motion of lips and tongue (motor). The two last-mentioned centres are already developed at birth, and the two first centres develop within a few days of birth. Soon the four subsidiary centres develop, viz. : (1) the auditory-word centre in connection with the hearing centre ; (2) the motor-speech centre in connection with the centre for motion of the lips and tongue ; (3) the visual word centre in connection with the visual centre ; (4) the writing centre in connection with the hand and arm centre. In time, all these centres connect up, via association fibres and dendrites, so that impulses can be transferred from one centre to another. When these centres have developed and linked the child can speak and write words which he hears (dictation) or sees (transcription).

Order of Development. (1) The auditory-word centre develops first, i.e. the child can hear words as distinct from other sounds. Next, he associates words with ideas, because the auditory-word centre connects up with other parts of the brain which store up impressions. (2) The motor-word centre develops and connects up with the auditory-word centre, and now the child can imitate the sounds heard. The visual centre connects up with the motor-word centre and with the part of the brain where impressions are stored, and so, on seeing a dog, the memory of the word representing the animal is called up and the child says it. (3) At this stage he goes to school and the last two centres develop there, connecting up with each other and with the two first centres. The teacher must remember that these centres can only develop slowly. Hence the child cannot write before the writing-centre develops, or read before the visual-word centre develops, or write from dictation before the auditory-word and writing centres have linked.

Word-deafness, in which the child cannot understand or remember what he is told, does not recognise his own name, etc., is due to the absence of the auditory-word centre. The child may be erroneously classed as deaf or imbecile. Fortunately the condition is very rare.

Word-blindness, in which the child cannot recognise letters or words and therefore cannot read and writes rubbish, is due to the absence of the visual-word centre. It is commoner than word-deafness, Dr. C. J. Thomas estimating that 1 in 1000 Elementary School Children show this defect, and they are likely to be sent to schools for the mentally defective, e.g. Dr. Thomas states that out of 30 cases examined in such a school, 4 were cases of pure word-blindness only. Word-blindness may occur in later life, as a result of disease. The child can draw and recognise pictures, and therefore can write from transcription, but not from dictation, because the sound does not produce any mental picture of the word. Dr. Kerr, in his *School Hygiene*, states that *letter-blindness* is much rarer than word-blindness, because the child usually learns letters as a muscular memory; also that Arabic numbers and all combinations of figures are generally well recognised, and that the word-blind can nearly always write their own name correctly because it is the equivalent, to them, of a single sign.

Characteristics of the Child's Nervous System. (1) The chief characteristic is *instability*, due to the fact that the child's nervous system is still immature and growing. Hence it easily tires. There is very little reserve of nervous energy, because growth makes great demands on it; hence what there is is quickly exhausted. Yet mental activity is necessary because it brings a greater flow of blood to the brain, removes waste faster and therefore promotes growth. The thing to remember is to stop short of overstrain. Hence one needs a carefully constructed time-table with the right length and sequence of lesson. It has been calculated that the times for which a child can fix its attention are as follows: From 6 to 9 years old for 15 to 20 minutes; from 9 to 12 years old from 25 to 30 minutes; from 12 to 14 years old for 35 to 40 minutes; 15 years old and over from 40 to 45 minutes.

Puberty brings with it a period when the natural instability of the child's nervous system is greatly intensified, and for a time it may become morbid and cease to function properly. Girls especially need careful handling at this time, and, unfortunately, this is the period when we so often send them in for examinations involving overstrain through cramming, nervous anticipation, and so on. Undoubtedly we want a more rational system.

Among the child's remaining mental characteristics perhaps the most striking are : (2) Lack of control of emotions. (3) Little power to resist sensuous gratifications. (4) Spontaneity, and closely connected with this (5) the difficulty of discipline, i.e. discipline doesn't come by nature to the child, though one should remember that it differs from other young animals in that inhibitory power is developing, and this makes discipline more possible and more necessary with the child than with any other young animal. (6) Emulation is pronounced, and by its means you can train the child to a reverence for what is right, by providing object-lessons. (7) Craving for approval. (8) Imitativeness—which should be made the most of in education. (9) Curiosity, which should be recognised, trained and directed.

Sleep is the cessation of conscious life, and the amount which a child gets is vitally important. In sleep, heart anc breathing slow down, less blood goes to the brain and more to the skin, and all the organs have a recuperative rest. I a child has deficient sleep it cannot do good mental work anc it tends to become nervous and neurotic. Dr. Kerr state that one night's loss of sleep can be detected by psychologica tests for nearly a week, though the sufferer may be quite un conscious of it, and that in observations on young animals total loss of sleep seemed more important than loss of food Hence one of the outstanding objections to half-time labou and to work out of school-hours.

Quality of Sleep. Sleep is deepest and most refreshin during the first two or three hours. Then follows a period o shallow sleep in which external impressions have most effec and when, therefore, we get most dreams, these being largel due to external stimuli. Finally we get a period of dee sleep just before waking. To get the right kind of slee various conditions are wanted, the chief being :

1. Fresh air.

2. Quiet. Though we are unconscious in sleep, a sub conscious knowledge of external impressions exists, an therefore sleep in a noisy room is less refreshing than in quiet one.

3. Sufficient but not too much warmth. The bed-cloth

should be moderate in weight and amount, and the temperature of the air should not be over 60° F.

4. Darkness. Hence the evil of keeping the baby's cradle in the family living-room till the parents go to bed.

5. Regularity. There should be a fixed bed-time, for it is easy to develop a sleep-habit which is of great value in ensuring the right amount and kind of sleep ; it is impossible, however, to do this if the child goes to bed at all sorts of irregular times.

Amount of Sleep. This is as a rule deficient both at home and in boarding-schools. Different authorities give slightly different amounts for various ages, but the following table gives a fair average :

From	4 to 8	years old child needs	12	hours.
,,	8 to 12	,, ,,	11	,,
,,	12 to 14	,, ,,	10	,,
,,	14 to 20	,, ,,	9	,,

Provision for sleep should certainly exist in all infant schools, instead of in a few only as is the case to-day. Some schools turn the little tables upside-down and sling hammocks from their legs ; others use hammocks in low frames or on trestles, and so on. Under seven years old all children should have at least forty minutes' sleep every afternoon, and they should not be allowed to sleep in their seats or leaning on a desk or table. It would be far better to let them lie on the floor, say on newspapers, but some kind of hammock is best. At Summer Lane School, Infants Department, they have composite hammocks, in which the nets are boiled monthly or oftener. The head mistress states that :

The average time when sleep was general was 2.38 p.m.
,, ,, awakening ,, 3.41 ,,

This gives one hour as the natural sleeping period.

Much of the success of the open-air schools is due to the midday rest, and Sir G. Newman, in speaking of the Nursery Schools which voluntary enterprise has established already in some places, and which will probably be shortly established in many places by Education Authorities, says that the children should have their midday meal at school and an after-dinner sleep of from one and a half to two hours. These schools are designed for children between two and five years old.

Sleeplessness is often very hard to cure, but on no account should drugs be given. All sleeping-draughts, etc., contain opium, which has a particularly bad effect on children. Useful remedies are:

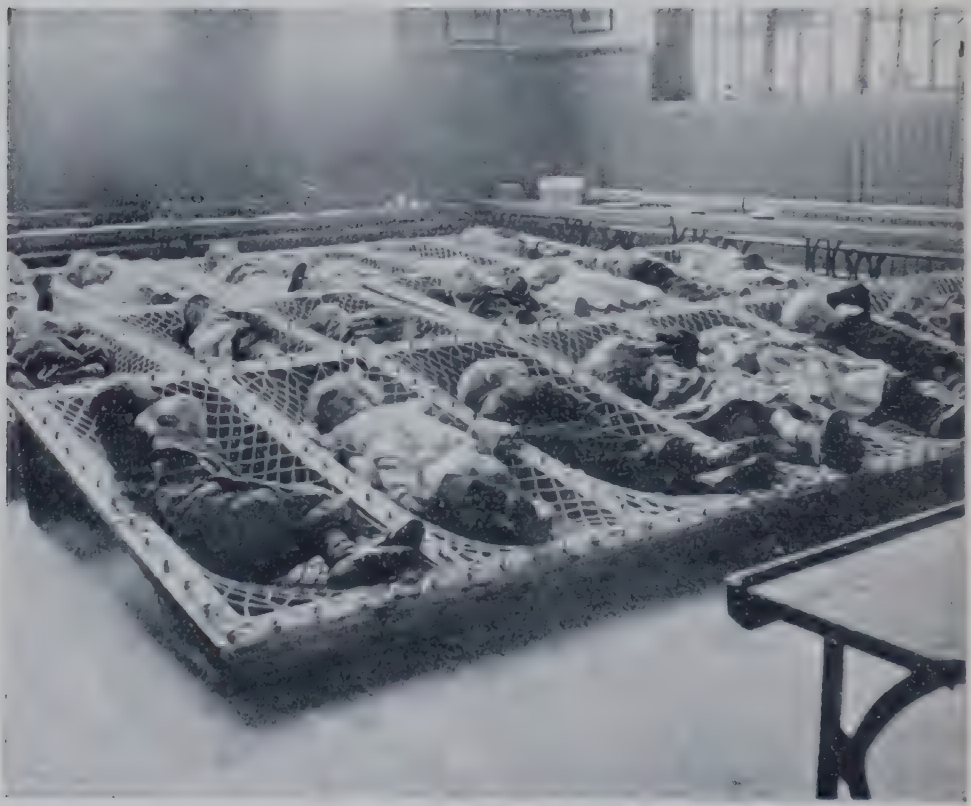

Fig. 55. Hammocks

(From Dr. G. A. Auden's Report, 1910, to Birmingham Education Committee)

1. A little hot food just before going to bed.
2. A hot bottle.
3. No work for half an hour before going to bed.
4. Plenty of fresh air and exercise in the day-time.

Sleeplessness is often a sign of overwork, in or out of school, and its cure may lie in the lightening of this work.

CHAPTER XII

MENTAL DULNESS AND DEFICIENCY

Classification—Causes—Existing educational provision—Character of education—After-care—Symptoms of defect—Moral defects.

SOME knowledge of the prevalence, causes, types, symptoms and treatment of this class of child is of very great importance, both for the child's own sake and for the well-being of the State. We are here supposed to consider only the types of defect which are *educable*, but for clearness it is well to get an outline classification of all the types, and a useful one is as follows: (1) Dull and backward. (2) Mentally defective:—(*a*) Feeble-minded, (*b*) Imbecile, (*c*) Idiot.

I. **Dull and Backward.** All teachers are acquainted with this type, for mostly they are being taught in the ordinary schools, where they fail very largely to profit by the instruction given and form a constant source of annoyance and trouble to the teacher. The returns made by the School Medical Officers for various districts give numbers between 13·6% and 0·8% of school children as belonging to this class. The wide variation suggests a probable lack of uniformity in the standards by which the children are judged. However, the number is undoubtedly large,[1] and much can be done for them, but before considering this point one should get an idea of the *causes* of dulness and backwardness. These causes are many, including: (1) Rickets—these children often pick up at seven or eight years. (2) Adenoids—causing deafness. (3) Eye-defect. (4) Malnutrition. (5) Illness, necessitating long absences from school. (6) Nomadic life of parents, causing absences from school. (7) Brain defect, usually hereditary. Now the backwardness due to causes (1) to (6) is curable, given suitable education and the remedying of the cause. That due to (7) is incurable. The *treatment* needed is, first, the removal of the cause if possible, e.g. attention to sense-defects such as deafness, short sight, etc., good food, removal of adenoids, etc., and then education (1) in special classes in the ordinary schools, with small numbers so as to make individual attention possible, or (2) in special schools of the open-air type, serving a whole town or district.

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[1] In 1929 the Mental Deficiency Committee estimated the number as 500,000 children "retarded" by two or more years, i.e. two or more years below the average mental level for their age.

II. **Mentally Defective.** (*a*) **Feeble-Minded.** In 1908 the Royal Commission on Feeble-Mindedness estimated that one in two hundred children belong to this class, and Sir G. Newman's 1920 Report to the Board of Education states that there are thirty-one thousand feeble-minded children in England and Wales.[1] These children are capable of being taught to earn a living under favourable circumstances, but are incapable (1) of competing on equal terms with normal people, and (2) of managing themselves or their affairs with ordinary prudence; i.e. they need life-long supervision.

Cause. Twenty-five out of thirty-five witnesses giving evidence to the Royal Commission attached supreme importance to the fact that in a very large proportion of cases there is a history of mental defect in parents or near ancestors, (1) Sir Clifford Allbutt says, "I regard feeble-mindedness as hereditary. . . . Feeble-minded persons are prolific; the thing can only be bred out." An instance was given of a feeble-minded woman who had four feeble-minded girls, all of whom had feeble-minded children. Descendants of the original woman included more than one hundred feeble-minded. (2) Dr. Ashby, Medical Officer to Special Schools at Manchester, says, "In at least seventy-five per cent of feeble-minded children there is strong probability that the disease is hereditary." He added that he had observed no special tendency in children of alcoholics to feeble-mindedness. (3) Mr. Frederic Wilkinson, Director of Education, Bolton, says that in almost every case where parents of mentally defective children appeared before the Committee or magistrates, the parents themselves were defective. (4) Sir E. Ray Lankester says, "Congenital feeble-mindedness is hereditary and *not* brought about by starvation or other such conditions, but is probably due to easy conditions of life and the absence of the selection that obtains amongst more primitive men." The Commissioners, in summing up, emphasise (1) the hereditary nature of feeble-mindedness; (2) that prevention of the mentally defective from becoming parents would tend largely to diminish their number; (3) the mentally defective should not live at large, but in institutions. N.B.—Many feeble-minded men and women drift into workhouses before thirty. In maternity cases amongst these a tremendous number of illegitimate children are born.

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[1] The Mental Deficiency Committee's Report (1920) estimates that there are 300,000 mental defectives in England and Wales, including 105,000 feeble minded children between the ages of 7 and 16, and 40,000 imbecile and idiot children. The percentage was higher in the country than in towns (about 16 : 10). These figures show an *alarming increase* in the last twenty years.

Existing Educational Provision for the Feeble-Minded. Education Authorities have provided for about 17,000 of these children, in the form of 180 Certified Schools, of which 159 are Day Schools and 21 Residential. The ideal is that the Residential School should be part of a Colony, such as Sandelbridge Home, Great Warford, Cheshire, so that the children may continue under life-long supervision. Dr. Kerr says, "Only superstition prevents the permanent segregation, or better still sterilisation before puberty, of every case that requires education as feeble-minded." Probably the cost of Colonies explains why they are so few and emphasises the desirability of preventing child-bearing in these people. The Mental Deficiency Committee think that about four-fifths of the feeble-minded children need Special Day Schools and about one-fifth need Residential Schools. Hence our existing provision is obviously not only very inadequate, but the Day Schools are in much too high a proportion relatively to the Residential. *Character of Education.* (See Report of Chief Medical Officer of the Board of Education for 1912.) (1) The school should be on the outskirts of the town, so that it can have a large playground and be of the open-air type with gardening, etc., possible. Till now they have mostly been placed *centrally*, but facilities for transit are now much improved and largely do away with the objection to an outskirt position. (2) The *curriculum* should provide adequate physical education by means of training in personal hygiene, games and physical exercise. Each child should have towel, brush and comb, and tooth-brush. Shower baths should be installed. A midday meal is desirable from both the physical and the educational points of view. Education should be very practical and manual, since the children show much more aptitude for practical pursuits than for acquiring abstract ideas, and physiologists hold that brain-development is encouraged by this means. Direct and formal intellectual instruction is of little use, but children should be taught objectively and incidentally to read, write and count if possible, but if they prove incapable of this it is best not to waste time on it. They may still succeed at handwork, but if this, too, is impossible, they should be dismissed from school. *Manual work* should include gardening, cooking, carpentry, laundry, housework, book-mending, basket-work, tailoring, metal-work, etc. At least half the school time should be given to it. From fourteen to sixteen the child should specialise in one form of work by which he may earn a living. Such manual work should be chosen as will stimulate faculties by securing the interest of the children. Often much time is given to making objects of no practical interest to the children, e.g. bent iron paper-racks, which could not find a useful place in their own homes. On the other hand, the making of clogs, boots, their own clothes, etc., has much more value as a mental stimulus, and in some special schools, e.g. Bristol Street, Birmingham, this principle is acted upon.

After-Care of the Feeble-Minded. It is now recognised that this is *absolutely essential.* In London it is done by the *After-Care Association for Elder Mentally Defective Children,* founded in 1910. In most cases the teachers bear a large share of the work by keeping in touch with ex-pupils, encouraging them to visit the schools freely, arranging evening socials and helping them in everyday life. Members of the Committee do useful work in certain schools in getting employment for the children. *Objects of the Association:* To co-operate with parents and other agencies in getting suitable employment for the children leaving the schools; to try to find homes for the children needing custodial care; to keep in touch with children by visiting them; to collect statistics of the numbers of children needing permanent supervision In 1913, seventy per cent of these were employed, but the percentage varies widely according to whether the After-Care Committee is thorough or slack.

Symptoms of Mental Defect. These may be classed as (1) Mental. (2) Physical.

(1) **Mental Symptoms** vary greatly, but usually the child shows retarded development, greater in some directions than others, and individual peculiarities in mental powers. Thus *attention* is poor, as shown by dulness or wandering thought. *Memory*, which is closely connected with though not wholly dependent on attention, varies greatly. It is often possible to educate defectives to a daily routine, but they need constant supervision. *Will* is very little, and in this fact lies the great danger of letting defectives loose on the world. *Association and ideation* are poor, owing to deficiency of association-fibres and nerve-cells, and hence *reasoning and imagination* are weak also. *Imitativeness* is strong. *Speech* develops late and defects are very common; e.g. one observer found defective pronunciation of one or more consonants in thirty-two per cent of his feeble-minded cases and "*lalling*" or substitution of consonants is common. Fortunately speech is very amenable to tuition, and this not only benefits the various brain centres, but also the wage-earning capacity in later life.

(2) **Physical Symptoms.** (*a*) *Defects in size or shape of head*, the commonest being smallness and asymmetry, to the extent of thirty-four per cent and twenty-six per cent respectively in Lapage's cases. (*b*) *Deformities of the external ear.* These may be in one ear only, and include absent or deficient lobe, excessive breadth, diminished height, smallness, protusion, etc.; thirty-two per cent of Lapage's cases showed ear-defect. (*c*) Deformities of palate and jaws, such as very narrow high palate, cleft palate and hare-lip, but here mouth-breathing and comforters may be the cause. Sixty-seven per cent of Lapage's cases showed this defect. (*d*) Abnormally small mouth and eyes, or eyes too close. (*e*) Abnormally small nose, due to insufficient growth of nasal bones. (*f*) Stunted growth. The above are often called "*Physical Stigmata*" or "*Stigmata of Degeneration,*" and too much stress has been laid on them in the past. All that one can say is that if many of

them occur in an individual, there is a strong probability that he is abnormal. *Other physical characteristics* include lack of control of features and movements, twitchings, etc., clumsy, awkward carriage, power of walking develops late, poor circulation and resistance to disease.

Moral Defects. Such children have been called moral cripples because they are deficient in moral sense; e.g. the organic stealer, liar, disobedient, mischievous. Apparently this is due to defect in the brain-centres which store up moral impressions. These cases, though capable of self-support, are a menace to society.

Treatment is difficult, though school-measures+home-measures can usually do something, but usually these children fail as adults. Special schools are needed, partly because these children must be removed from contact with others.

Child Guidance Clinics. Of late years a good deal of attention has been given, especially in America, to children who show what are called "behaviour problems," e.g. abnormally bad behaviour at home or at school, eccentricities, great nervousness or fear, inclinations to theft, spitefulness and so on, and Child Guidance clinics, staffed by mental specialists, have been established in various places, in order to study this type of child, discover the cause of its abnormality and, if possible, remove that cause, so restoring the child to a normal condition of mental health. It is found that sometimes wrong conditions at home, such as lack of discipline or some other unwise treatment lie at the root of the trouble. Sometimes the mistake may lie in school-life,—but wherever it can be remedied the child may be cured, and thus saved from degenerating into a hopeless nuisance to home, school and society—ending possibly in prison or asylum.

Child Guidance Clinics now exist at several of the big London hospitals, in connection with the Jews Free School, and at Bath and Liverpool. Others are being planned in various of the larger towns.

The remaining two types of mental abnormality are *ineducable* and so beyond the scope of our work. They are: (*b*) **The Imbecile** who is incapable of earning a living but has the instinct of self-preservation, and needs a Residential Home, and (*c*) **The Idiot,** who lacks even the instinct of self-preservation and should be in an asylum; e.g. he will try to eat glowing coal.

CHAPTER XIII

FATIGUE (MENTAL AND PHYSICAL)

Definition—Cause—Symptoms—School-factors influencing fatigue—Tests—Type of child liable to mental fatigue—Only one kind of fatigue.

FATIGUE may be defined as the sum of the results of activity which show themselves in a diminished capacity for doing work.

The *cause* of mental fatigue is the using up of the potential energy of the nerve-cells and the formation and accumulation of waste-products (toxins) in them, and the more immature the cell the faster does this happen. Now, since education involves changes in these cells, development of new connections between them, and so on, it must involve fatigue, and this is as it should be. It is only *continued* fatigue, which is not easily recovered from, that is bad.

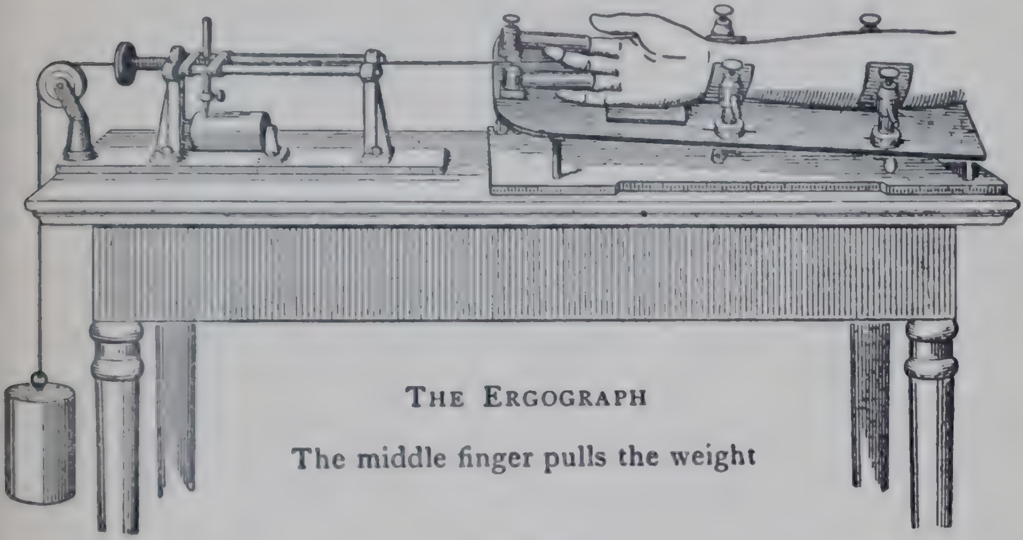
Symptoms of Mental Fatigue. (*a*) *Normal and transient*—yawning, lassitude, inattention, drowsiness, fidgets, slow or faulty response to questions or commands. (*b*) *Continued and abnormal* (over-pressure). (1) The position of the hand when held out in front at the word of command gives a useful indication. In normal children it is flat and in line with the arm ; in nervous children it drops slightly at the wrist, and the fingers are arched and thumb bent back ; in exhausted children the whole hand droops. (2) Tell the child to hold out both arms in front. If not level it is a sign of fatigue. (3) Head balance impaired, head leaning forward or sideways. (4) Abnormal reflex action, such as jumping at a slight noise. (5) *Facial signs :* (*a*) Frontal muscles over-acting, causing horizontal and vertical creases in the forehead. The latter may be due to eye-strain, caused by long sight. (*b*) Relaxation of the muscle surrounding the eye, causing baggy lower lid. (*c*) Mouth open (may be due to mouth-breathing). (*d*) Expression of exhaustion. (6) Irregular muscular movements of the body. (7) Irritability. (8) Headache. (9) Dulness. (10) Inability to sleep at night, night terrors, walking in sleep. (11) Pale, poor appetite, digestion and circulation. (12) Over-pressure predisposes to chorea, hysteria, epilepsy.

In the Elementary School chronic fatigue is rarely the result of school work, though not uncommon as the result of out-of-school work. The amount of fatigue due to school work depends not only on the *amount* of work, but also on the *conditions* of work, e.g. on length of lesson, arrangement of subjects, ventilation, light, noise, posture. The *fatigue-values* of different subjects vary for different children, but the usual order is : mathematics, languages, religious knowledge, science, nature-study, singing, writing, drawing. The most exacting work should come when children are fresh, i.e. at the beginning of the week, day and term. Two and a half hours is long enough for one session. Homework should involve revision only, and there should be none till the child is twelve.

Tests of Mental Fatigue. In recent years much attention has been devoted to the measurement of fatigue and various methods have been invented. They may be divided into two groups : (1) Direct. (2) Indirect. *In the direct method* fatigue is measured by capacity for mental work, and, where possible, by work of the same nature as that producing the fatigue. *In the indirect method,* fatigue is measured by some secondary phenomenon resulting from it, such as change in the rate of the pulse, in capacity for *bodily* work, in the sensitiveness of the skin, etc.

Examples of Direct Measurement. (1) The amount done and the mistakes made in the first ten minutes of a lesson compared with the amount done and the mistakes made in the last ten minutes. (2) Addition, subtraction or multiplication tests before and after an arithmetic lesson. (3) Dictation tests before and after any lesson.

Examples of Indirect Measurement. (1) *By the Ergograph,* an instrument invented by Professor Mosso, of Turin, the pioneer worker on fatigue. Here, the hand and arm are strapped to a table, leaving one finger free, and to this finger a weight is fastened by a string passing over a pulley. The weight hangs over the edge of the table, and the finger is moved up and down as long as possible. Fatigue is estimated from the work done by the finger before exhaustion sets in. This involves the assumption that bodily work decreases in proportion to mental fatigue, and this assumption is not a proved fact ; hence the results cannot be taken as quite trustworthy. (2) *By the Æsthesiometer*, an instrument invented by Griesbach. It has two points, the distance between which can be varied. The smallest distance on the skin at which these can be felt as two is measured, and is supposed to



The Ergograph

The middle finger pulls the weight

Fig. 56.

(From Jewett's *Control of Body and Mind.* Ginn and Co.)

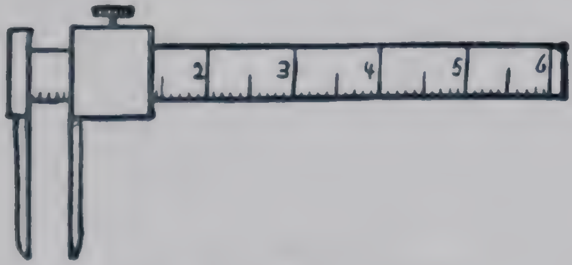


Fig. 57. **Æsthesiometer**

indicate fatigue, since it increases with fatigue; i.e. the sensitiveness of the skin to touch decreases with fatigue. However, we have no proof that the decrease is proportional to the fatigue, and hence again the results cannot be taken as trustworthy. (3) Instruments for measuring blood-pressure and changes in pulse and respiration have also been used. (4) *By Weichardt's Massive Arm and Leg Movements:* Here a dumb-bell is held in each hand, with the arms in the forward-stretch position. They are then moved outward in quarter-circles and back again, once per second, to a word of command. With each movement the right and left feet are raised alternately to knee-level. After from twenty to thirty seconds this becomes more difficult, and suddenly the arms sink. The time which elapses before this happens gives a measure of the fatigue, but again it is not certain that the time is inversely proportional to the fatigue. (5) *By the Antitoxin method.* This also was invented by Weichardt, who states that the blood forms an antitoxin which is an antidote to the toxins produced by fatigue, and which can be used to measure fatigue. The value of the method, however, needs further confirmation. Hence, on the whole, direct tests are more reliable than are the indirect.

Type of Child specially Liable to Brain-Fatigue. One must remember that fatigue sets in at different rates with different children. The type specially liable to it is the delicate, nervous, emotional, irritable child; also the anæmic, ill-fed, quickly growing and mentally precocious; also those exposed to bad air, bad light, bad time-tables, unhealthy home conditions, too little sleep; and those with defects of sight or hearing; and, lastly, those just at puberty. *The phlegmatic type,* on the other hand, has a strong nervous system, with slow response of brain and muscle, is often unambitious, with good memory, refusing to be forced, and is very free from nervous fatigue.

Muscular Fatigue is due to the production of toxins in the nerve-cells and muscles used faster than they can be got rid of by the excretory organs, and the result is accumulation of poison. This poison chiefly affects the brain-centres controlling the muscles, so that they cease to control the muscles properly, and further, the brain-cells produce the *sensation of fatigue.* Hence *all* fatigue is really chiefly fatigue of the Nervous System. (See also Chapter III.)

In order to emphasise the fact that, at bottom, there is *only one kind of fatigue,* let me give two extracts from Mosso :

1. "The nervous system is the sole source of energy ; and although we must admit a certain amount of localisation, this is not of such a nature as to prevent the neighbouring organs feeling any loss through the great activity of any one organ. The exhaustion of energy is general ; and all the magazines of energy can be drained by the exaggeration of any activity whatever of the organism. The conclusion to which we are led by my experiments is that there exists only one kind of fatigue, namely, nervous fatigue ; this is the preponderating phenomenon, and muscular fatigue also is at bottom an exhaustion of the Nervous System."

2. "Cerebral fatigue diminishes the force of the muscles. The exhaustion is twofold, central and peripheral. This explains why after brain-fatigue one feels one's energy exhausted by the slightest movement, and why every obstacle which we have to overcome seems to have grown more serious. In these circumstances, violent exercises should be avoided, because they are injurious : fencing, gymnastics, or any muscular effort whatever aggravates the conditions of the organism. It is therefore a physiological error to interrupt lessons to make children do gymnastics, in the hope that this may diminish brain-fatigue. To restore the forces of the organism after exhaustion by intellectual labour there is no remedy other than immobility and letting one's thoughts wander. When we force the nervous system to muscular after cerebral effort we find the muscles less fit to work, and we add to the cerebral fatigue another fatigue which, as we shall see later, is of the same nature and is equally harmful to the Nervous System. The best way to rest is to sit still and 'think of nothing,' and to let children play and amuse themselves in the open air."

One more extract, giving Mosso's suggestion as to how brain-fatigue affects capacity for muscular work : "Between the muscles and the brain there are only two ways of communication; the nerves and the blood. If we regard the brain and the muscles as two telegraph offices, we can understand that the nerves which join them do not suffer from fatigue. But the central, or psychical station, may influence the peripheral or muscular station, even if the latter is not doing work, seeing that both brain and muscles are irrigated by the blood. The blood current may introduce into the muscles some injurious substance which has been produced in the brain as the effect of its activity. It is also possible that it takes useful substances from the muscles to convey them to the brain, which requires large supplies of energy for the work of thought."

CHAPTER XIV

THE SENSES AND THEIR TRAINING—SIGHT

Value of senses and their training—The eye: structure and uses of lids and eyeball—Vision—Defects of vision (long and short sight, astigmatism, squint) and common eye-diseases—Their relation to school and home conditions, heredity, and general health—Part taken by teacher in detection and amelioration—Vision tests.

THE five senses, of sight, hearing, smell, taste and touch are of enormous importance in our lives, since it is through them that we are able to enter into relations with the external world. These five senses, together with a sixth, called the muscular sense, are the avenues by which all information reaches the mind, and for this reason they have been called the five outposts of the mind. Any defect in the development of the senses makes contact with the environment less perfect than it should be and inevitably handicaps the owner, and the more serious the defect the greater is the resulting isolation and loss. The story of Helen Keller, the American child who at the age of one year and five months lost both sight and hearing and hence became dumb, depicts very vividly the desire for expression and companionship and the awful sense of bondage which possessed her before the education of her sense of touch enabled her to pass, as she says, "From darkness into light." Through touch she learned first how to communicate with others by means of the hands, then how to speak orally and to "hear" others by feeling the movements of their lips and throats, and how to read and write by the Braille system.

Since the senses are of almost infinite value to a human being, it behoves us to see that we so treat them that they may attain a full development. Now, it is sometimes said that life will do this, without our troubling about any special sense-training—but is this really true to our everyday experience ? We all know that our capacity for enjoying music depends considerably on the training of the ear, that full appreciation of the beauty of colour in art or nature depends on the training of the eye to note differences of shade, contrast, etc., and this suggests that the sense-organs do not, apart from definite education, attain the degree of development which makes them the best possible servants of the mind, or even of industrial efficiency. Again, it is an accepted fact that civilisation deprives the sense-organs of much of the training which uncivilised life brings in its train, simply because the senses are not, to the civilised man, such essential weapons in the struggle for survival as they are to the savage. Hence they are less used and consequently atrophy to some extent. The superiority of the senses of sight, hearing and smell in many of the lower animals compared with man can be similarly explained. It is therefore safe to say that some early and definite sense-training is valuable to every child and especially to that great army of children whose sense-organs are markedly below the average, for thus the defect is likely to be discovered *early* and means can then be taken to remedy it, where otherwise it may remain undiscovered and prove a permanent handicap. A defect discovered thus through the ordinary school work, owing to the child's failure in some test of skill which can be easily performed by the other children, often impresses the parent more than the fact that the doctor schedules the child as short-sighted, hard-of-hearing, etc.

Another argument in favour of sense-training is that it involves brain-training, since every sense organ is connected by nerves with a definite brain-area. The brain, like all other organs, needs use if it is to develop, and the various brain-centres are so connected that a strengthening of one may very probably tend to strengthen other and possibly higher centres.

As to methods by which the senses may be educated, one cannot do better than read Mme Montessori's descriptions of the system and apparatus by which she develops the senses even of defective children.

The Eye. The eye is the chief of the sense-organs and its importance cannot be exaggerated. Poor eyesight is a heavy handicap educationally and in later life. About thirty per cent of children in elementary schools have defective vision, and of these seventeen per cent need treatment. It is worth noting that the sight of children living in the country is distinctly better than that of children in towns.

Structure of the Eye. The eyeball is placed in a bony socket lined with fat and protected in front by lids. In the lids are two kinds of gland. (A gland is a structure which manufactures a useful fluid or gets rid of a harmful one from the blood.) Those in the lids are the lachrymal and the meibomian glands.

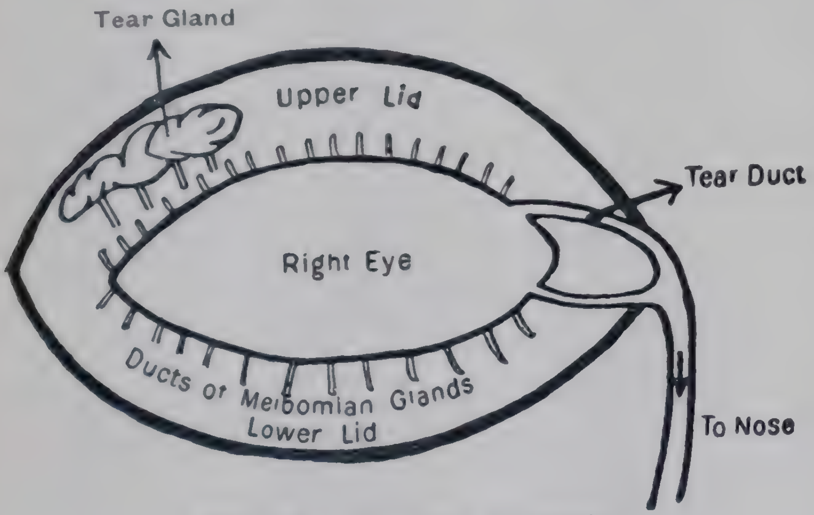


Fig. 58. Diagram of eyelids

1. *A lachrymal* (*or tear*) *gland* is placed in the upper lid of each eye, towards the outer corner. These manufacture the secretion called *tears* and pour them out by several little tubes opening on the inside of the lid. The function of tears is to wash the eyeball free of dust, etc., and when this is done the washing-up water, so to speak, drains off into the nose by two tiny holes in the inner corner of the lids, which you can see easily. Hence the use of blowing the nose if something gets into the eye. The amount of tears is influenced by

emotion, and if it is excessive we are said to *cry*, and then the quantity of fluid is too great for the tear-duct to carry off, and so tears roll over the edges of the lids.

2. *The meibomian glands.* There are many of these, opening by tiny pores on the edges of the lids, amongst the eyelashes. Their function is to make oil which prevents the tears, unless excessive, from running over the edge of the lids. (Cp. greasing the lip of a beaker or jug before pouring liquid out of it, to prevent trickling down the side.) A block in the mouth of one of the meibomian glands produces a *stye*, and is very likely to result from rubbing eyes with dirty hands, and the tendency to rub is often due to defective sight and consequent tiring and irritation of the eyes.

The Eyeball is fastened to the socket by six muscles, in three pairs, of which one is attached to the top and bottom and one to the sides of the eyeball so that it can *turn* in any direction, e.g. if the inferior rectus contract we look down, if the internal rectus contract we look towards the nose. The eyeball is spherical, except in front, where it bulges. It has three coats: (1) the sclerotic coat; (2) the choroid coat; (3) the retina. The *sclerotic* coat is tough, white,

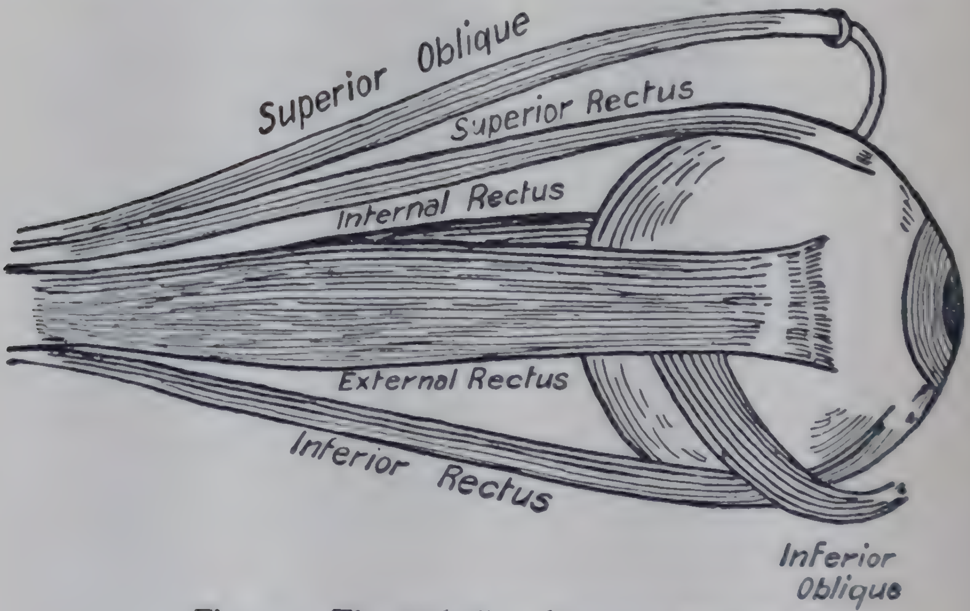


Fig. 59. The eyeball and ocular muscles

(From Narramore's *Preliminary Physiology*. Methuen) fibrous and opaque except in front, where it is transparent and called the *cornea*. Its function is to protect the inner part of the eye and keep the whole ball in shape. The *choroid* coat is black and full of blood-vessels which bring *nourishment* to the eye, and the blackness prevents the reflection of rays of light entering the eye. Towards the front it becomes coloured, and hangs down behind the cornea, forming the iris. There is a hole in the centre of the iris, called the *pupil*. The iris contains two sets of muscle-fibres, one circular and one radial, and therefore can contract or expand the pupil. The *retina* is a very delicate fibrous expansion of the optic nerve which enters the eye at the back. A small part of it, opposite the centre of the lens, is called the *yellow spot*. Behind the

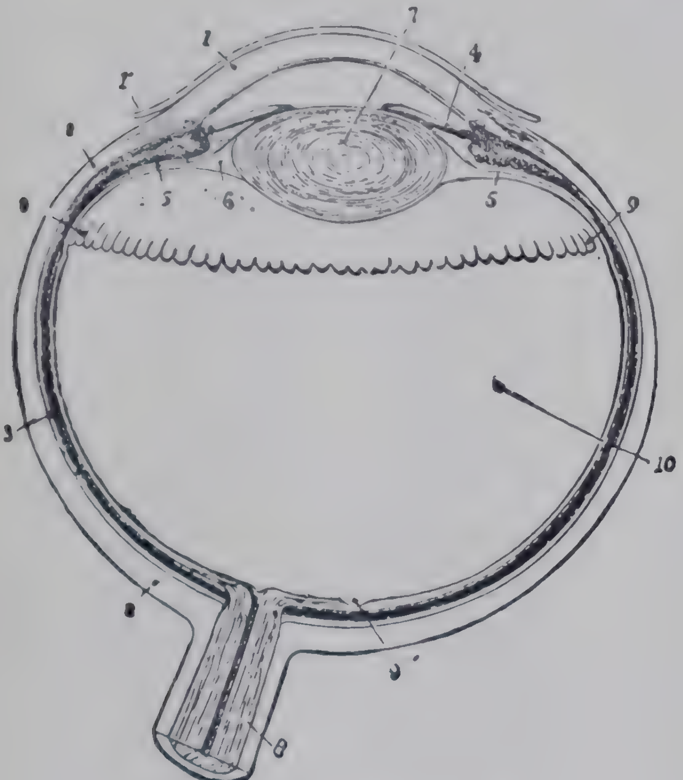


Fig. 60. Section of an eye

1, cornea; 1′, conjunctiva; 2, hard coat or sclera; 3, blood coat or choroid; 4, iris; 5, focussing muscle; 6, lens ligament; 7, lens; 8, optic nerve; 9, front fringe of retina; 9″, central spot of retina; 10, jelly packing eye

(From Harman's *Eyes of our Children*. Methuen) iris is suspended the *crystalline-lens*, which is convex and hung on ligaments which are connected with the ciliary muscles in the walls of the eye. It is worth remembering that these muscles are very small and easily tired. The convexity of the lens can be increased by the action of these muscles, the change being called *accommodation*. The rest of the ball is full of a clear jelly-like stuff behind and a watery stuff in front of the lens.

Vision is due mainly to the action of the lens on light rays falling on it from the objects seen. If clear vision is to result, these rays must focus on the retina, i.e. an image of what is seen must be formed on the retina. Now a normal eye is so constructed that it focusses *distant* objects (anything over twenty-five feet) without accommodation of the lens, but for anything nearer, accommodation is needed. The reason is that rays striking the eye from a distant point are approximately parallel. Focussing means that the rays are bent till they meet on the retina. Now for a *near* object, the rays are

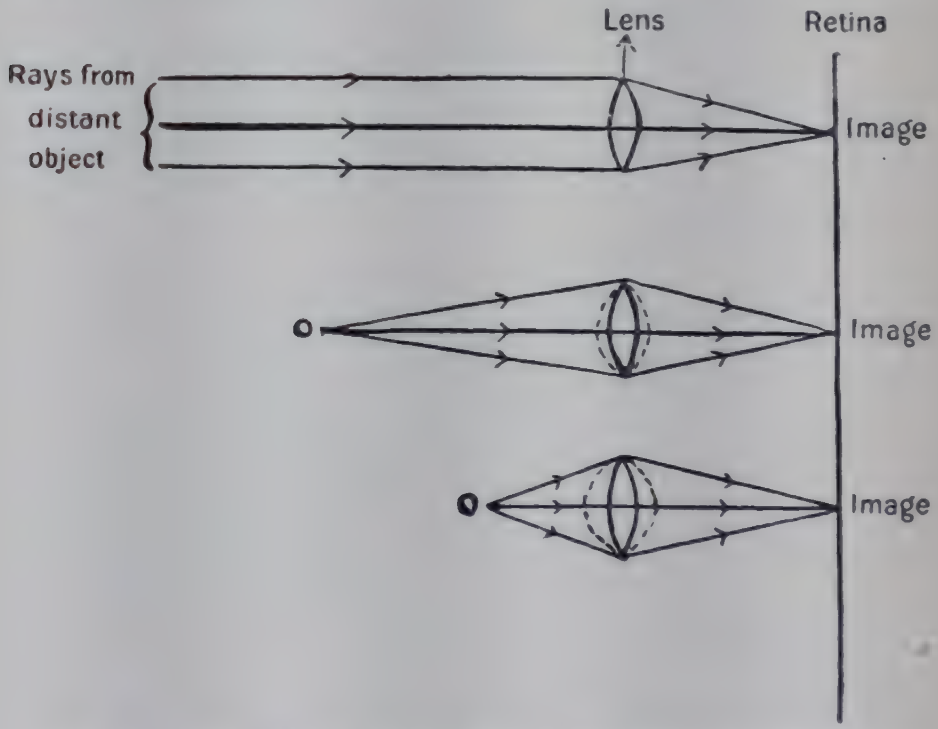


Fig. 61. Dotted lines show shape of lens when accommodated for near object (O)

divergent, and therefore more bending is needed to make them meet on the retina, and increased bending can only be got by making the lens *more convex*, and this means that the ciliary muscles must contract, i.e. accommodation occurs. The nearer the object the more accommodation is needed, and finally we reach a limit, beyond which if the object is brought nearer, we cannot see it clearly.

A second condition of clear vision is that the image should fall on the yellow spots of *each* eye, and this means that the axes of the eyes must converge so that if produced they would meet on the object. This *convergence* is brought about by the muscles fastening the ball to the socket, chiefly by the contraction of the internal recti. Obviously, the nearer the object the greater the convergence and therefore the greater the strain on the muscles. The mechanism for convergence is not developed

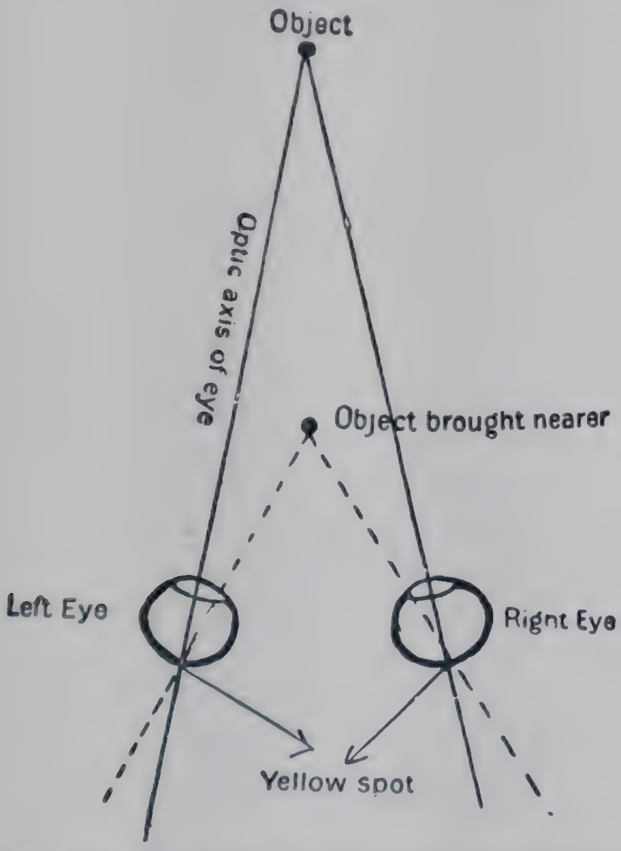


Fig. 62. Diagram illustrating convergence

during the first month of life and therefore a baby often squints at this stage, and mothers are unnecessarily alarmed. Obviously also, accommodation and convergence are interdependent, one always occurring with the other. This explains why *too near* work is bad; it tends to strain the muscles of the eye, and constant contraction of the internal and external recti squeezes the eyeball out of shape in time, elongating it from back to front, and so producing the structural defect, *short sight.* Apart from this the tired eye-muscles make the eyes ache, the child rubs them and introduces dirt which causes styes, inflammation, etc. Headaches also result. The child may hold its work too near for various reasons, such as too fine work, habit, bad light, short sight, bad posture.

Short Sight (Myopia). This is caused by the ball being too long for the lens. Hence parallel rays focus in front of the retina, i.e. the image *on* the retina is blurred. Now, to *remedy* this one needs a flatter lens, and this being an impossibility, the only thing to do is to put a spectacle-lens in front of the eye. This lens must be concave and so bend rays outward before

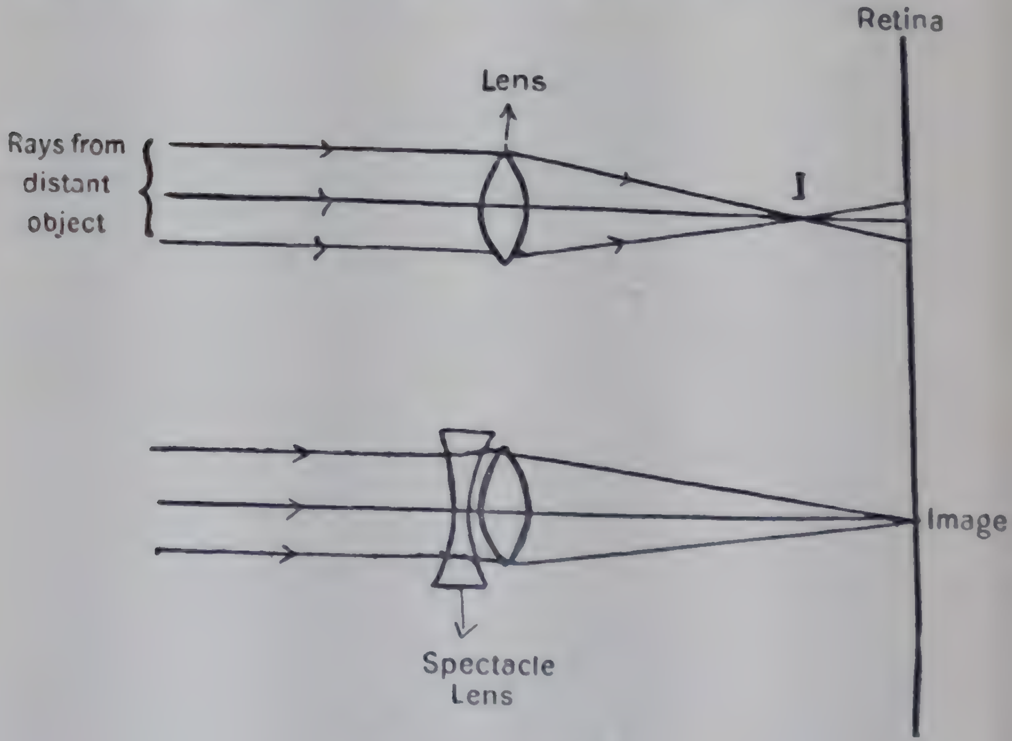


Fig. 63. Short sight

they strike the eye. Nearer objects can be seen clearly, and therefore a short-sighted person tends to pull everything close to him. This means that excessive convergence occurs, out of proportion to the accommodation, and so the converging muscles are tired and the eye squeezed so that the defect *tends to increase* sometimes very rapidly, possibly ending in blindness.

Causes of Short Sight. The defect is never inborn, but is probably due to the great recent increase of reading and lack of adaptation in the eye. The future may bring better adaptation. The *tendency* to short sight is strongly hereditary. However, at present, the chief causes lie in the school and the home during school age, e.g. bad light, bad print, bad desks, fine sewing, malnutrition. To these may be added the cinema, where the child usually sits in the cheap seats near the front and therefore has to look up, and continually move its eyes from side to side, and this, together with the smoky hot air and the joggling of the pictures, produces eye-strain and headache. Dr. Kerr says that no child under fourteen ought to be allowed in a cinema after 7 p.m., nor allowed to sit within fifteen feet of the screen, or to see a film which has not been specially approved for children.

Symptoms of Short Sight. Some have already been mentioned, e.g. the tendency to pull all work close. Others are headache, inattention and apparent dulness, insomnia, inflamed eyes and lids, watering of the eyes, rubbing, mistakes in reading from the blackboard, styes. Protruding eyes with very big pupils suggest short sight.

Prevention and Remedy depend on (1) removal of causes of eye-strain; (2) prompt detection of defect by teacher and school doctor; (3) prompt treatment of defect by teacher and school doctor, e.g. the child may be put in the front of the class, or given spectacles, and if the defect be severe he may be sent to a *myopic or semi-blind class* or school, where the education is specially adapted to prevent progress of the disease.

Myopic or Semi-blind Classes. It is best if these classes are attached to an ordinary school, for then no stigma attaches to them in parents' eyes; also the myopes can take oral lessons, drill, games and dancing with the ordinary children. The classes are small, with not more than twenty children in each. The desks have flat tops which turn back and have blackboard underneath (with lines two inches apart sometimes) on which most of the writing is done. No ordinary

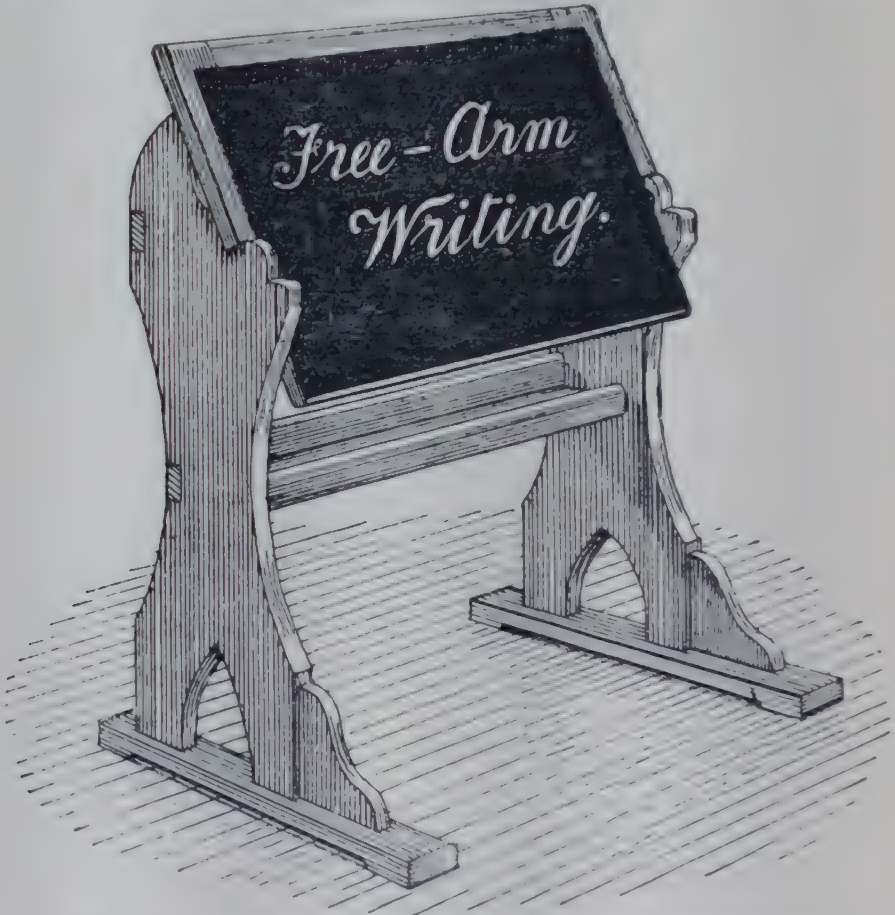

Free-Arm Writing.

Fig. 64. Myope desk, serves as table and blackboard
(G. Hammer and Co., Ltd.)

pens or pencils are used, but the higher classes have exercise books of black paper on which the children write with white chalk, the books being clipped to the desk blackboard and the writing done free-arm. Wall blackboards are also provided, sometimes with lines four inches apart. The eldest children print their work, two sets of type being provided for each class. The type consists of rubber-faced letters one inch and two inches high, and the results go to form a class-library useful for subsequent teaching. *Drill and games* enter largely into the time-table, some games being "instructional," e.g. large sheets of scenic canvas are put on the floor and the teacher draws a huge outline map, marking chief cities, mountains, rivers, etc., and the children walk about on it, pointing out the different spots with sticks. *Manual work* has to be very carefully chosen because it must not involve fixed attention from the eyes. Hence sewing is prohibited, but knitting can be taught because the children can often learn it quickly and then do it automatically. Modelling of maps, rough woodwork, using rulers whose smallest division is a quarter of an inch, basket-work, bent iron, netting of hammocks, tennis-nets, etc., simple cookery and laundry are all suitable, but *not* raffia-work.

Long Sight. All children are born thus and some never get over it, but it does not increase. The *cause* is a too short

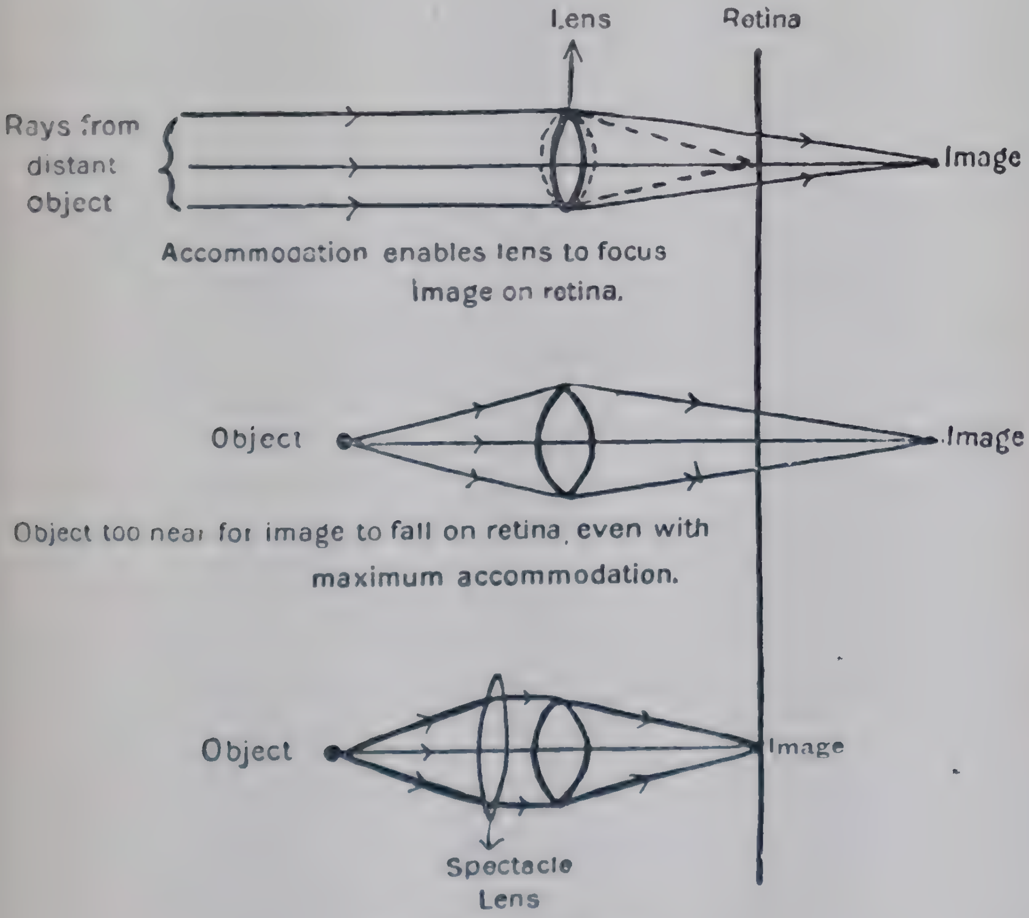

Lens
Retina
Rays from distant object
Image
Accommodation enables lens to focus image on retina.
Object
Image
Object too near for image to fall on retina, even with maximum accommodation.
Object
Image
Spectacle Lens

Fig. 65. Long sight

eyeball. Hence, apart from accommodation, rays from a distant point focus behind the retina and therefore the image on the retina is blurred. This is remedied by accommodation, which bends the rays more, so that they focus on the retina. However, near objects need more and more accommodation and finally a limit is reached, within which the object cannot be seen clearly. Now this means that the long-sighted eye is even more exposed to strain than the short-sighted eye, for its accommodation muscles never have a rest. Hence the *symptoms* are very like those of short sight, with the exception that often the child holds things a long way off (but not always). Small, deep-set eyes, with contracted pupils, should suggest long sight. The *remedy* is a convex spectacle lens, which has the effect of making the eye-lens, to all intents and purposes, more convex, and so more able to converge rays. In old age long sight tends to occur owing to the lens losing its power of elastic recoil, so that focussing is difficult.

Astigmatism is by no means uncommon in children or adults. The *cause* is unsymmetric curvature of the eyeball, specially of the cornea. This defect has been called the spoon-shaped eye, and is generally congenital. *The result* is that objects look blurred, and the sufferer contracts the ciliary muscles *irregularly* in the effort to pull the ball into shape, and so muscle-strain results, and the head is often held sideways because rays in one direction focus more easily than in others. For the same reason the eyes are often narrowed to chinks. *The remedy* is spectacles with lenses whose curvatures are unequal in different directions, so that they counteract the inequalities in the eye-curvatures.

Squint. This is commonest at about three years old, and convergence squint is the most frequent form, i.e. one or both of the eyes turn inward. It is caused by more or less paralysis of a rectus muscle, usually the external rectus, due to unequal vision in the two eyes, or to poor brain-control over the eye-mechanism, or to both causes acting together, with the result that one eye is used to the exclusion of the other. Squint tends to run in families, i.e. weak brain-control or inequality of vision is inherited and this favours the development of squint. In such families special care should be taken to avoid eye-strain, particularly when the children first go to school. It might for instance be wise to forbid homework.

The fact that a baby so often squints during its first month of life is due to the absence of the necessary brain-control over the two eyes. In older children, sudden squint is due to brain-trouble, e.g. meningitis. Apart from these temporary cases, the right treatment is either (1) to shut off the good eye and so make the child use the squinting eye, which can be done by means of spectacles, belladonna, covering the good eye, etc., *or* (2) to operate. The operation consists in shortening the stretched muscle and lengthening the shrunken one. It is very important to take a squinting child to the doctor as soon as possible, because a squinting eye quickly becomes practically blind, and even if the eyes subsequently become straight they will never, in this case, recover their full use.

External Eye-Diseases

Under this term are included those diseases which affect the lids and external parts of the eyeball—especially the conjunctiva and cornea.

1. **Blepharitis or "Sore Eyes,"** means inflammation of the lids and is chiefly due to dirt and neglect. It mostly occurs amongst mal-nourished children from dirty homes. Defects of vision are a predisposing factor because they lead to eye-strain, and so the child rubs its eyes and gets dirt into them. The symptoms of the disease are redness and thickening of the lids, formation of scabs on their edges and the falling out of the lashes.

Treatment, in severe cases, is needed for months, but in slight cases ordinary cleanliness and frequent bathing with a lotion of bicarbonate of soda, followed by the application of an antiseptic ointment, will cure the disease quickly. If visual defect be present, spectacles will also be needed in all probability, and therefore every case should be reported to the school doctor.

2. **Stye** has already been mentioned, in connection with the meibomian glands.

3. **Conjunctivitis** is inflammation of the transparent membrane (conjunctiva) covering the front of the eyeball

and the inside of the lids, and the disease has various forms, some of which are very infectious, being conveyed by hands, towels, sponges, etc. Hence, when an epidemic of the disease occurs in school, it is well to forbid children to wash in school unless separate towels are provided.

Symptoms of Common Conjunctivitis

(*a*) The eyes look red; hence the name "pink-eye," which was first applied to a similar condition in the eye of the horse.

(*b*) There is an extra discharge of tears, mixed with matter, or pus, and during the night this cakes on the lashes so that the lids are often stuck together in the morning. This discharge is very infectious.

(*c*) Light causes pain, and so the patient shrinks from it, but it is a mistake therefore to bandage the eyes, as this keeps the pus in and one wants to get rid of it, which is best done by frequent bathing of the eyes. If special lotions be needed, the doctor will prescribe them.

Phlyctenular conjunctivitis is another form of the disease, causing little white spots on the cornea and great pain, so that the child keeps its eyes shut. Unless promptly treated, ulcers form and permanently injure the sight, and a good many cases of defective vision are caused thus. The disease appears oftenest at five years old and is often associated with decayed teeth, adenoids, mouth-breathing and malnutrition. It seems to be therefore largely the result of general ill-health, and cure depends on two things: (*a*) the building-up of the general health, and (*b*) treatment by an oculist. These children benefit greatly if sent to an open-air school or convalescent home.

Purulent conjunctivitis or ophthalmia neonatorum. This is acute inflammation of the conjunctiva accompanied by discharge of thick yellow pus, and appears within a day or two of birth. It causes an enormous amount of blindness; e.g. it has been estimated to account for one-quarter to one-third of the cases in the European and American schools for the blind. It is due to a germ from the mother's body getting into the child's eyes during birth, and was made notifiable in

1899, because it is very contagious. Also, the Midwives Act compels every midwife to wash the new-born baby's eyes with suitable lotion, and immediately to send for a doctor if inflammation occur. The result of these measures has been a considerable decrease in the disease recently.

4. **Cataract.** This is due to the lens becoming opaque and may be congenital or may develop later. Some types of congenital cataract are hereditary. Cases developing later may be due to illness, e.g. rickets. If the opacity be so severe that the sight is much interfered with, the lens should be removed, and spectacles must then be worn to do the work of the lens.

Vision Tests. Should be done on entrance and yearly afterwards. The favourite test is Snellen's type. The card should be put 20 feet (6 metres) from the child, in a good light, and the child should stand with its back to the light. Then try if it can read the 20-foot line. If not try it on the 40-foot (12 metres) line, and so on. Record the results as fractions ; thus if it can only read the 40-foot line at a distance of 20 feet, its vision is $\frac{20}{40}$. (1) Test each eye separately, covering the other with a card which does not touch it. (2) Do not test till at least six years old, for if younger the child may see properly but not interpret properly. (3) Do not let the card hang permanently in school, or the children will learn it by heart. (4) If the child has glasses, test with them on. (5) Note facial distortion or inclination of the head during the test, because these indicate astigmatism. *For children under six*, Cohn's type can be used, consisting of " E's " with their legs pointing in various directions. The child is asked to say which way they point.

CHAPTER XV

THE EAR AND HEARING

Structure of ear—Hearing—Causes, signs and prevention of defective hearing and ear-disease—Tests and degrees of deafness—Education of the deaf and semi-deaf—Word-deafness.

THE ear is the second sense-organ in importance.

Structure. It is divided into three parts—the outer, middle and inner ears.

(*a*) The outer ear consists of the *auricle*, or flap, whose function is to collect sound-waves and hand them on to the *auditory canal*. This tube is about one and a quarter inches long and its end is closed by the *drum*, a thin membrane. The canal-lining contains cells with secrete wax which tastes bitter and whose function is probably to deter insects from

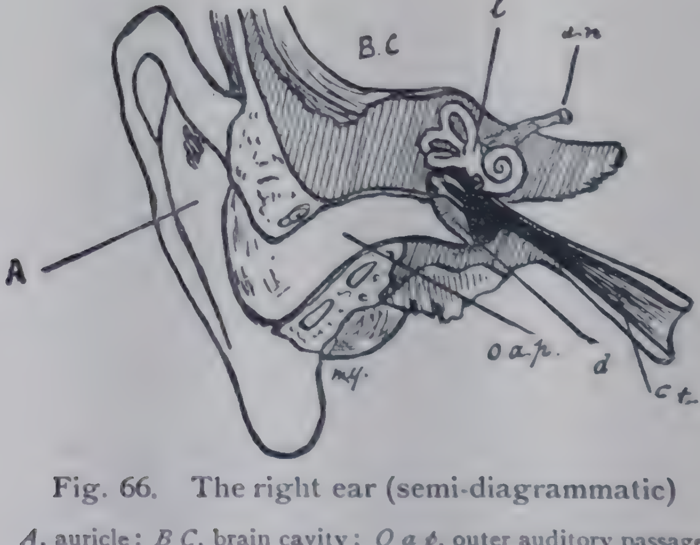


Fig. 66. The right ear (semi-diagrammatic)

A, auricle; *B C*, brain cavity; *O a p*, outer auditory passage; *l*, labyrinth; *d*, drum; *E t*, Eustachian tube; *a.n.*, auditory nerve. The bone is shaded; the cavity of the middle ear is black

(From Yearsley's *Throat and Ear Troubles*. Methuen) entering the canal. However, if the ears are not washed the wax accumulates too fast and blocks the drum and produces deafness. Also, apart from cleanliness, some people naturally secrete a large amount and the ear periodically gets blocked. *Treatment :* Drop in warm oil and then get the doctor to syringe the ear, after a few hours.

(*b*) *The middle ear* is a cavity in the side-bone of the head, about the size of a hazel-nut, lined with mucous membrane, and communicating with the throat by a tube (Eustachian) about the size of a quill pen, and opening in the pharynx. This tube admits air from the throat to the middle ear, and this arrangement also explains why an unhealthy state of the throat so often affects the ear. Germs in the throat can spread up the Eustachian tube to the ear and there set up inflammation and abscess, which may eat through the drum and pour a discharge of pus into the outer ear. Also, an abscess is always liable to eat through the bone separating the middle ear from the brain, in which case death almost certainly results. Also it is likely to eat through and destroy the ligaments connecting the three little bones which carry sound across the middle ear to the inner ear, and this means permanent deafness. Hence if one wants to preserve one's hearing it behoves one to keep one's throat healthy, and one sees at once the importance of adenoids, enlarged tonsils, sore throat, etc. On the inner wall of the middle ear is an oval opening closed by a second drum, and between the two

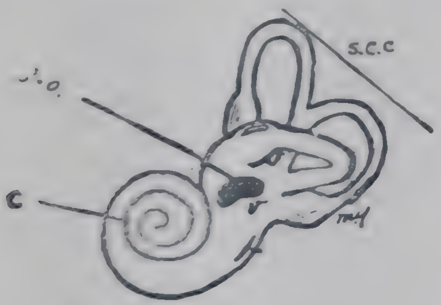


Fig. 67. The inner ear

c, cochlea; *v*, vestibule; *s c c*, semi-circular canals; *f o*, oval window

(From Yearsley's *Throat and Ear Troubles.* Methuen) drums stretches a chain of three little bones connected by ligaments and called, because of their shapes, the hammer, anvil and stirrup.

(*c*) On the further side of the inner drum is the *inner* ear, consisting of a little chamber about the size of a barley grain and called the *vestibule*, because of the four tubes which open out of it. One of these is coiled up like a snail's shell and is called the *cochlea*. The other three are semicircular in shape and not only start from, but also come back to the vestibule. The whole of the inner ear is full of fluid, and in the cochlea are the ends of the auditory nerve which connects the ear with the auditory centre in the cerebrum, whilst in the semicircular canals are the ends of nerves which pass to the cerebellum. The former are concerned with hearing; the latter are concerned with the balance of the body, and if the semicircular canals are injured we become *giddy*, not deaf.

Hearing. Sound is due to air-waves, set up by some vibrating body such as a violin string, a piano wire, the air in an organ-pipe, the vocal cords in the human larynx, and so on. These waves of alternately compressed and rarefied air travel out in all directions from the vibrating body like ripples on a pond when you drop a stone in, and when they strike the drum of the ear they set it vibrating. These vibrations are transmitted by the bony chain across the middle ear to the inner drum, which is also set vibrating and transmits its vibrations to the fluid in the inner ear. Now in this fluid hang the ends of the nerve of hearing, and the result is that the nerve ends are affected and impulses are sent from them along the auditory nerve to the auditory centre in the brain. The brain converts the impression into the *sensation* which we call sound. The auditory centre has a sub-department, as you will remember, called the *auditory word centre*, which enables one to recognise words and distinguish them from other sounds. This is one of the four brain-centres specially concerned with speech and writing, and hence is of great importance educationally. The other three are the *motor speech centre*, the *visual word centre* and the *writing centre*, and if a child is to speak and write and read properly, these centres must all exist and must all connect with one another.

Defective Hearing. *Prevalence.* In 1915 there were probably about 5,550 deaf or partially deaf children in England and Wales. Of these about 4,000 are in special schools. There is a very much larger number of children who have some defect in hearing and who are in the ordinary schools; generally twelve to twenty per cent of all children have some degree of defective hearing.

Causes of Deafness. Deafness may be *congenital* or *acquired.* (1) If congenital, a common cause is syphilis in the parents. One-half of the deaf and dumb are congenitally deaf, and about 15% of these can transmit the defect to their children and hence ought not to marry. (2) If acquired, the commonest causes are measles, scarlet fever and meningitis producing changes in the middle ear. This, at any rate, holds for semi-deaf and "hard-of-hearing" children. When the deafness is so great as to prevent the development of speech or to cause acquired speech to be forgotten, it is almost always due to changes in the inner ear. Deafness in children is nearly always associated with, and often due entirely to mouth-breathing. Mouth-breathing again may be due to habit, adenoids, or enlarged tonsils. *Adenoids* not only lead to mouth-breathing, but also they block the throat-end of the Eustachian tube and so cut off the air-supply from the middle ear, and this means that the air in the ear is gradually absorbed by the lining of the ear and therefore the cavity becomes a partial vacuum and the drum is forced in by atmospheric pressure and therefore does not vibrate properly. The symptoms of adenoids include open mouth and therefore a vacant expression and the "veiled look" of the eyes, the voice is flat and toneless, the speech suffers, e.g. "m" becomes "b," and "n" becomes "d," etc. Bad respiration means insufficient oxygenation of the blood and the child flags, becomes inattentive and suffers from headache. Removal of adenoids in time nearly always means recovery of hearing. Mouth-breathing means that the air taken in is not filtered of germs and dust, nor warmed nor damped as it is if passed through the nose. Hence it strikes the pharynx (i.e. top of the throat) and tonsils cold, dry and full of germs, and it therefore irritates the throat and germs are likely to lodge there and produce scarlet fever, diphtheria, etc. These germs can spread up the Eustachian tube to the middle ear, there set up inflammation, matter forms, and the abscess bursts through the drum and may cause the destruction of the bony chain conveying sound to the inner ear and therefore great loss of hearing. (See Chapter V.) "If a running ear be not healed quickly, say within a month or two, and the condition become chronic, it is very difficult for healing to take place because the deeper bony structures have become involved. If both ears be thus affected, a pretty high degree of deafness may result, but unless the internal ear become affected, the deafness is not likely to be so great as to cause dumbness. A greater misfortune than dumbness may befall the child. Infection may spread to the brain and cause meningitis. Meningitis of this type is nearly always fatal. When deafness of very high degree comes on before five or six years, speech is apt to disappear, unless preserved by oral teaching."[1] Wax has already been mentioned as a cause of temporary deafness.

Signs of Defective Hearing and Ear Disease. (1) The child misses spoken words or directions, specially if he cannot see the teacher, because deaf children often learn to lip-read. (2) Strained attention at the start of a lesson, quickly degenerating into inattention, owing to tiredness. (3) Head often on one side, because one ear is better than the other. (4) Mouth-breathing. (5) Earache. (6) Headache. (7) Discharge from the ear. (8) Singing in the ears. (9) Giddiness. (10) "Spurious" mental defect. "There is more backwardness due to defective hearing than to defective sight." (Dr. Kerr Love.)

Tests for Hearing. Knowledge of this is much vaguer than is that of eye-testing. There is only one really good way, and that is by the human voice, and the most uniform method of applying the test is by whispered speech.[2] "Watches, acoumeters and tuning forks are of scientific and diagnostic value, but the school-child's progress depends on his being able to make out the speech of his teacher, hence speech is the test the latter must apply." (Dr. Kerr Love.) Whispered speech is not strictly *voice*, because the vocal cords are not used in it; it is only the upward current of air modified by the tongue and lips, but it is more uniform in pitch and intensity than true speech. Now it is very important to define the *kind of whisper* to be used. Some people think it is a whisper with all the air you can get into the lungs behind it, such a whisper producing a noise which Dr. Macleod Yearsley compares to "the death-rattle of a despairing and infuriated elephant; a bellow which can be heard at one thousand yards rather than twenty-five metres," which is the correct distance for a normal ear to hear a whisper; i.e. the right kind of whisper is by no means a "stage" whisper. It is whispering *at the end of expiration*, and the test should consist of two or three unconnected numbers or words pronounced consecutively. *Precautions in testing:* (1) Test the ears separately, an assistant closing the ear not being tested by the moistened forefinger pushed well into the canal. (2) The whisperer must be *at the side* of the child and the child must look straight ahead and not at the mouth of the whisperer. Unless this precaution be taken the child will lip-read. (3) The room must be *quiet*, and at least twenty feet long; thirty feet is better.

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[1] Dr. J. Kerr Love in *The Deaf Child*.

[2] This statement must now be modified, for an improvement on the whisper has been discovered, viz. the audiometer (See Appendix VIII.)

Degrees of Deafness. The average hearing distance for a whisper in a noiseless room is *twenty-five yards*, and "a child who hears it at *five yards* is not likely to be backward on account of deafness," so one sees how great the margin of "spare hearing" for the child is. Anything worse than this strains the child's attention and makes it advisable to put him in the front of the class or in a small class where he can get individual attention. This does not mean that a child loses nothing if his hearing distance is reduced from twenty-five yards to five yards; he will lose a good many sounds in ordinary family life and in the outside world, but he will hear the teacher's raised voice all right. An easy rule, known as the "*six-foot rule*," is as follows: If the child cannot hear a whisper with at least one ear at six feet he will find it difficult to keep up with the work of the ordinary school. Dr. Kerr Love's classification of the partially deaf is as follows: (1) Children who hear whispers at five yards but not more may be called *slightly hard of hearing.* (2) Those who hear only at one to three yards are *moderately hard of hearing*, and many become backward. Hence they should be put in smaller classes and the teacher should speak slowly and distinctly, and if the child can be taught to lip-read it will be a great gain, not only in school, but in later life. (3) Under a hearing-distance of one yard the child may be called *semi-deaf*, and should be removed from the ordinary school to a special class taught by an articulation teacher where there are not more than ten or twelve children. A child as deaf as this often has defective speech, especially if the deafness has come on very early. The eye must be called in to help the ear, i.e. the child *must* be taught lip-reading if he is to compete on equal terms with normal children and later on with normal adults. Till quite recently the semi-deaf have been sent to institutions for the deaf and dumb, whose processes of thought are different. Hence the half-deaf *should remain at home and attend special day-school or class.* There are at present only six such classes, in London and Bristol. Along with the half-deaf should be placed the quite deaf who have *some* speech left. They are sometimes called the *semi-mute*, and their thought processes are more like those of the hearing child than of the deaf and dumb. "Spotted fever" sometimes accounts for this state.

Methods of Educating Deaf-Mutes. The systematic education of the deaf started about 1760, with the work of de l'Epée in France. He and his successor, Sicard, "did all that enthusiasm and genius could do to perfect a system of signs, and they failed. They based their system on the fallacy that signs are *the* natural language of the deaf . . . the only one in which the deaf could think or reason. Now, signs are no more the natural language of the deaf than they are of the hearing, but in the absence of speech they are the best the untaught deaf can do in the way of finding a substitute for speech. Speech is natural to both deaf and hearing children, but both have to learn it, and in the absence of hearing, this task is very difficult; hence deaf children fall back on the easier and more primitive language of signs."[1]

Simultaneously, Heinicke, in Germany, was advocating the teaching of *speech* to the deaf, and it is because his principle is right and de l'Epée's wrong that the *oral method* is displacing the *sign-and-manual* method for *all but the mentally deficient deaf*. The oral method is that by which the teacher tries to make speech the means of communicating with others. The *manual or finger-spelling method* is that by which finger-spelling is used as a means of expressing thought, and a "combined" method is practically impossible, because the finger-language is more easily learned and deciphered than speech and therefore tends to crowd out speech. This does not mean that signs and finger-spelling have no place in the education of the deaf-mute. "In the early stages of the child's learning, gestures and signs cannot be avoided. In the later stages they are unnecessary, whilst finger-spelling can always be avoided by using writing, a safer, if a somewhat slower, means of explaining a new word than finger-spelling. The latter is dangerous in the schoolroom, and its use imperils both the speech and the lip-reading of the child."[2] If the speech habit is to be firmly fixed, speech must be insisted on and sign-language as far as possible prohibited. This means that one *must* separate the mentally defective deaf from the ordinary deaf, for the former *can* only be taught finger-spelling and the latter *should* not be taught finger-spelling. This separation is not made in most of our deaf schools, and hence the admixture of manual and oral methods, which is unsatisfactory in theory and practice. The mentally defective deaf should be placed in institutions *for life*. The ordinary deaf should spend their first few years of school life chiefly in acquiring articulate speech so that a vocabulary of common words is used automatically. This means slow intellectual progress for the first two or three years, but it means better intelligence and better language in the end if the school course can be made long enough. After speech, *drawing* should be taught, and then *writing*. In England most children are taught some speech; in some institutions the teaching is wholly oral for most children, and those who are taught manually are separated from the orally taught, and although it is some way off, we are approaching the time when every deaf child of good mentality will communicate with other people by speech and lip-reading.

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[1] *The Deaf Child*, by Dr. J. Kerr Love.

[2] Dr. Kerr Love.

Deaf Children under School Age. At present we do not begin to educate the deaf child till seven years, and, as Dr. Kerr Love points out, the tacit assumption is that a deaf and a hearing child are alike at seven, whereas the deaf child at seven is only equal to a hearing child of one and a half or two years in many respects, and the loss between two and seven is irretrievable because these are the natural years of speech-development and therefore no other five years are like these. This is one reason why the results of the education of the deaf are not more satisfactory; it is also the reason for the demand for *earlier education* of the deaf. How can this be achieved? Two ways have been suggested: (1) Instruction of parents of deaf children in the principles of lip-reading. (2) Establishment of teaching arrangements for deaf infants between two and seven years, in (*a*) day-nursery schools, or (*b*) by articulation teachers visiting the homes and teaching both parents and children. The thing is to get the child t regard the movements of the muscles of face, tongue and lips as the means of expressing ideas. Probably one ought not to spend long, at this stage, on articulation, or expect t get good speech—but one would be developing the speec instinct *at the natural time*.

Types of School. Most deaf children can be educated i day schools and most parents greatly prefer this arrangement, which also costs less than institutional training. Ever large city should have one or more *evening classes* for teachin lip-reading to the adult deaf, and for continuing the educatio of the deaf who leave the ordinary deaf school at sixteen but need further training to place them on an equal footin with the hearing. There are now in existence thirty da and twenty-one residential schools for the deaf+six classe for the semi-deaf.

Word-deafness. May be congenital or acquired. "Hearing for musical sounds or even for the letters which compose words may be, and is usually, perfect, but the auditory memories for spoken words are destroyed. When a boy is clever with his hands and good at games, where the difficulty is chiefly with his acquisition of language, word-deafness and word-blindness should be sought for. Many of these cases are never discovered, and the children are passed off as stupid, the real cause of the dulness never having been discovered."[1] It is possible, unless the defect is bilateral, to train the speech centres on the *right* side of the brain to do the work of the hereditary speech centres on the left. If failure shows the defect to be bilateral, education should be by writing and the finger alphabet.

[1] Dr. Kerr Love.

CHAPTER XVI

SMELL, TASTE, TOUCH. MUSCULAR SENSE

Smell. The bone forming the roof of the nose is perforated by a number of tiny holes through which the nerves of smell pass from the brain into the upper part of the nose-cavity, where they hang freely. When we smell, minute particles from the odorous substance come in contact with these nerve-endings and stimulate them. Hence nervous impulses pass to the olfactory centres in the brain, where the sensation of smell results. Clearly, if we are to smell anything thoroughly, the air bearing the odoriferous particles must reach the top of the nose-cavity, and this explains why we instinctively sniff when we wish to smell anything. Conversely, if we wish to avoid an unpleasant odour, it is best to breathe gently whilst in its neighbourhood, so that the inspired air only passes through the lower part of the nose-cavity. The reason why a cold in the head so often impairs the sense of smell is that the mucous membrane lining the nose is then so swollen that the nerve-ends are practically buried in it and so the air cannot reach them.

The sense of smell is useful in three ways: (1) as a source of enjoyment, (2) as a defence against danger; e.g. it enables us to detect decay, escape of gas, etc., (3) as an aid to the sense of taste. This last use is due to vapour given off from the food in the mouth and passing into the pharynx and hence upwards into the nose. The value of the nose as an aid to taste can be experimentally tested by holding the nose and tasting, say apples and onion in close succession. The two will seem to differ very little in flavour.

Taste. The tongue is the organ of taste, in virtue of the fact that in it are situated the ends of the nerves of taste which pass to the taste-centres in the brain. Taste can only be detected when the substance tasted is dissolved, and so a solid must partly dissolve in the saliva before it is tasted. Then it stimulates the ends of the taste-nerves, impulses pass up the nerves to the brain, and here sensation is produced.

The tip of the tongue is most sensitive to sweets, the back to bitters and the sides to acid.

Extremes of temperature more or less numb the sense of taste, and therefore a good way of taking nasty medicine is to wash the mouth out with very hot or very cold water, then hold the nose and swallow the medicine.

Taste is assisted by smell in the way described in the last section.

Touch. The skin is the organ of touch, as explained in Chapter VIII, since the ends of the nerves of touch lie in the dermis. These nerves enable us to " feel " things, to recognise differences of texture, hardness, size, shape, temperature, etc.

The sensitiveness of the skin varies in different parts of the body according to the number of nerve-endings and the thickness of the epidermis in that part. This may easily be demonstrated experimentally by taking a divider with blunt points and applying them to the skin in different parts, in each case noting the minimum distance between the points which gives the sensation of *two* touches. The experiment can be carried out more accurately with the æsthesiometer described in Chapter XIII. One set of results is as follows :

POSITION	DISTANCE BETWEEN POINTS
Tip of tongue	$\frac{1}{24}$ inch
Tip of finger	$\frac{1}{12}$,,
Edge of lips	$\frac{1}{8}$,,
Cheek	1 ,,
Middle of back	3 inches

The greater the distance between the points, the greater is the distance between the nerve-ends, and hence the less is the sensitiveness of the skin.

The skin is more sensitive to touch when damp than when dry, and this explains why a workman sometimes moistens his thumb before testing the edge of a tool on it.

The eyes often help the brain to produce correct touch-sensations ; one is very likely to get an incorrect estimate of the size of an object which is felt but not seen.

The sensitiveness of the skin to *heat* varies in different parts of the body, but not in exactly the same way as does the touch-sense. Thus the parts most sensitive to heat are the cheeks, eyelids and elbows, and this explains why in ironing one holds the hot iron near the cheek to test its temperature, and why the temperature of a hot bath is tested by the elbow. The tongue, lips and tips of the fingers are not so sensitive as other parts. The skin, however, is of little value as an accurate guide to temperature because the sensation produced depends on other factors in addition to temperature, viz. on (1) the conductivity for heat of the object touched, and (2) the relative temperatures of the skin and the object. An explanation of these factors can be obtained from any textbook on heat.

Muscular Sense. This is a kind of subconsciousness derived from the muscular system, owing to the fact that sensory nerves pass from the muscles to the brain, and so the brain is enabled to realise what the muscles are doing and what are their positions and movements at any particular moment. In the brain impressions of muscular actions are stored up, giving a subconscious memory which is of great use in estimation and comparison of quantities and qualities such as distance, weight, roughness, hardness, etc. For instance, when looking at an object, the eyes must converge and the lenses bulge to an extent depending on the nearness of the object, and both convergence and accommodation are due to muscular action, as explained in Chapter XIV. After practice, we become able to estimate the distance of an object by the amount of muscular effort demanded of the eye-muscles when we look at the object, though we are not conscious of using our stored-up memories of previous muscular work done by these muscles. The truth of this explanation of our power of judging distance is borne out by the fact that a blind man suddenly restored to sight always at first complains that everything is touching his eyes, because he has no muscular sense of distance.

We have probably hitherto underestimated the value of this muscular sense in education and have relied too exclusively on appeals to eye and ear. Mme Montessori makes much use of exercises for training this sense, e.g. in writing she relies on the motor memory to direct the hand, instead of trusting to the eye. Hence her children can write nearly as well with their eyes shut as with them open. All teachers should remember that muscle-training is brain-training, and that here we have a means of making impressions on the brain, even when it is " deficient."

CHAPTER XVII

TRAINING THE CHILD IN THE PRACTICE OF HYGIENE

Cultivation of good physical habits at home and in school, monitorial work, inspections, "drills," the school premises as a pattern, baths, posture, place of Hygiene in time-table, type of lesson. relation to other subjects (science, domestic economy).

Training of the Child in the Practice of Hygiene. The test of good teaching of Hygiene in school is the extent to which the children put into practice the laws of health. If our teaching simply leads to a theoretical knowledge and a practice quite independent of that theory we can conclude once and for all that we have failed. Hence we must think out carefully how we can so practise our children in hygienic living that this way of life becomes automatic and habitual. Then we may proceed to strengthen the impression by giving reasons for that practice—but the right order is, Practice first and Theory second. Hence I should be inclined to give no regular time-table period to Hygiene until Standard V at earliest; below Standard V one can give an occasional lesson now and then as the need arises, e.g. on such a subject as the care of teeth, which needs to be dealt with fairly early, but the main bulk of the teaching should be practical and incidental.

The training in practice should, of course, begin at home, when the child is still a baby. The baby can be taught, e.g. to dislike being dirty, to breathe through the nose and not through the mouth, to chew instead of bolting its food when it arrives at the dignity of solid food, and to take plenty of physical exercise—provided that it is dressed in garments which make kicking and stretching and all the other instinctive movements of babyhood possible, and that it is not cooped up all day in a perambulator when it ought to be in a much more open and less confined space. Before it is one year old it should have its own tooth-brush. The habit of regular and long sleep can be developed in the baby by putting it to bed at a regular time and seeing that the conditions for healthy sleep are present.

When the child comes to the nursery or Infant School very thorough and careful attention should be paid to cultivating good physical habits—in these same matters of eating, excretion, the right use of the sanitary appliances, breathing, cleanliness and sleep. One scores here if the children have their midday meal at school, for this provides many chances of education in washing of hands, cleaning of teeth, right ways of eating, the habit of sleep after the meal, etc. One must never consider time spent over such matters as wasted : rather it is being spent in a most valuable and profitable way.

As the child grows older and enters the Senior School much may still be done to give it practice in healthy ways of life ; e.g. there should be a carefully arranged system of monitorial work whereby the children are made responsible, in rotation, for the ventilation and heating of the classroom, for its neatness and decoration with flowers, for its dusting if perchance the caretaker omit this rite. In the cloakroom and lavatory, monitors should be responsible for seeing that clothes are hung on the right pegs and that basins are left clean and empty—and, again, that windows are open. Supervision of lavatories and closets by the staff is exceedingly necessary since many children have had no home-training in the right use of such arrangements ; they may have seen the water-closet used as a receptacle for rubbish of all sorts, the bath used as a store-house for coal, and often they have little idea of the need for modesty and privacy. (See also Chapter XXIV.) A useful practical lesson is to divide the children into small groups and take them round the school premises on a tour of inspection and explanation of all the sanitary arrangements, including sinks, baths, basins, closets, ventilating arrangements, heating, drain-pipes and ventilators. Explain exactly how the various traps, etc., work and then let them write a description of what they have seen, illustrated with sketches. Such a survey will take more than one lesson—but it is time well spent.

In addition, there should be regular inspection by the staff of the personal cleanliness of the children. Thus daily inspection of face, hands, nails, neatness of hair, state of repair of clothing, cleanliness of boots and handkerchiefs, coupled with prompt despatch of those who do not pass muster to lavatory or home have revolutionised the standard of personal cleanliness in many schools.

Certain "drills" are useful, e.g. (1) Tooth-brush drill after the midday meal. This involves provision of tooth-brushes, numbered racks and mugs. Even if this be not possible the teacher should do his or her best to see that the children possess tooth-brushes at home, and by frequent enquiry and judicious praise and encouragement should try to implant the habit of brushing teeth. (2) Insistence on handkerchiefs, pockets in which to keep them, and handkerchief-drill before all breathing exercises does an enormous amount to benefit the individual child, by keeping the nasal passages clean and healthy and thus preventing mouth-breathing, with all its attendant ills (see Chapter V). Further, it prevents the peculiarly unpleasant appearance of the child suffering from "cold in the head" without a handkerchief.

The school itself should be a model, as far as possible, of cleanliness, good sanitation, ventilation, lighting and decoration, and more than anything else one needs to reform the lavatory and closet arrangements in many schools. The single, dirty wet towel, the cold water in winter and the absence of soap make washing a sorrow rather than a joy; it is time that the school lavatory was properly equipped with clean towels, hot and cold water, soap and nail-brushes, that the caretaker was compelled to keep closets scrupulously clean, and that all closets were of modern type, easy to keep in order and with separate flushes.

School shower-baths should be available in all districts where adequate provision of baths at home is difficult; they are invaluable as a lesson in practical hygiene, tending to the formation of a lifelong habit of cleanliness.

The provision of plenty of opportunities in school, playground, garden, playing-field, swimming-bath, holiday camp, etc., for physical exercise in various forms, formal and recreative, will again provide better lessons in hygiene than any amount of talk in class about the need for fresh air and exercise.

The careful insistence on good postures is, again, of much practical value.

During the last two years of school-life it is desirable to give Hygiene a place on the time-table, for the children are old enough to grasp the simpler principles and reasons underlying the rules which should now have been practised until habits of right living have been fixed. Still, however, it is well to combine practice with theory wherever possible ; e.g. first aid, mothercraft, sick-nursing are all subjects which should be taught by practice as well as by precept, and the lessons should be so arranged that *every* child does the practical work involved. Hints as to practical work in Mothercraft are given in Chapter XXVIII.

Further, one can now explain that in matters of health the individual owes a duty to the community in which he lives as well as to himself ; e.g. that carelessness about infection, in diseases like tuberculosis, may spread the disease widely, that carelessness about refuse leads to the increase of flies and of the various fly-borne diseases, that carelessness in marriage leads to miserable lives for the children of those marriages, and so on.[1]

Relation of Hygiene-teaching to other School Subjects. Obviously hygiene, based as it is on a number of sciences, can derive much assistance from various other subjects in the curriculum. Thus a knowledge of the elements of physics and chemistry is of great value in making clear the principles of ventilation, heating, clothing, lighting, and drainage ; some knowledge of geology makes clear the reasons why certain building sites are good and some bad, why some water-supplies are good, others risky ; botany and zoology prepare the way for understanding the structure and functions of the human body, especially in the matter of reproduction, and therefore they form the best preparation for instruction about sex. That instruction ought to be given in the Continuation and Secondary School, even if not in the Elementary School. Cookery, laundry, house-wifery and needlework are all subjects wherein the children learn to practise hygiene ; thus the cookery class teaches them right choice of food, how to test its condition, how to render it digestible by cooking, how to economise in prices and quantities, how to preserve food from contamination by dirt, flies, etc. If in addition the children cook the school-dinners, and subsequently eat them, the value is still greater, for they can lay tables, clear away and learn how a social meal should be eaten. The laundry class teaches practical cleanliness, and the housewifery class again shows the home, managed and furnished in accord with the theories taught in the hygiene class. Lastly, the needlework class should give much help in teaching children to make garments hygienic both in pattern and material.

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[1] The Board of Education's *Handbook of Suggestions on Health Education*, price 6d., 1928, is useful.

Hence the hygiene teacher should work in close collaboration with the teachers of these other subjects.

CHAPTER XVIII

PHYSICAL DISABILITIES OF CHILDREN—INFECTIOUS DISEASES

Duty of teacher—Germs—Relation of germ and body—Immunity—Symptoms common to most infectious diseases—*Measles:* symptoms, treatment, complications, how the teacher can help to prevent its spread, school-closure—Whooping-cough, Diphtheria, Scarlet fever—Smallpox and vaccination—Chicken-pox, Mumps, German measles, Infantile paralysis, Influenza, Sleepy sickness.

UNDER this head one includes all the conditions which *disable* children, either immediately or ultimately, and either wholly or partially.

Duty of Teachers. It is very desirable that the teacher should take an interest in the physical disabilities as well as in the mental state of the child, and this involves (1) some knowledge of the symptoms, treatment and results of diseases, and (2) the attitude of the co-worker with regard to the school doctor. The teacher can do invaluable work in picking out children who need special examination by the doctor. Parents often appeal to the teacher for advice as to the health of their children. Often the doctor's advice is not understood and the teacher can explain it. The teacher can often stop the spread of infection by prompt detection of symptoms—and exclusion. He or she can, as we said before, by steady pressure on the parents, often get *treatment* of the defects discovered by the doctor.

Infectious Diseases. These are due to *germs*, some idea of which must be possessed by both teacher and children. "Invisible dust" is a good description for school purposes. More scientifically, germs belong either to the vegetable kingdom, forming the class of microscopic and very simple plants known as *bacteria* or, more rarely, to the lowest class of the animal kingdom, viz. the *protozoa*. It is important to emphasise that an attack of infectious disease always arises from a previous case, though the connection may be very hard to find. Probably eighty per cent of the diseases notified cannot be traced to the source. It used to be thought that disease-germs could originate from harmless matter, but this idea is now exploded.

Relation of Seed (germ) and Soil (body). Whether the germ, after entering the body, produces disease or not depends on two things: (1) the quality of the germ, and (2) the condition of the body. (*a*) Germs may be *virulent*, or *attenuated* (or reduced), and the germ, to give the disease, must be sufficiently virulent and in sufficient amounts. (*b*) The body may offer the germ a suitable or an unsuitable soil to grow in. The majority of people escape, i.e. are non-susceptible to a germ at any particular time; e.g. about ten per cent would be the maximum susceptible proportion of the population to typhoid, as proved in recent epidemics, such as those at Maidstone and Worthing. Any devitalising cause which lowers the general tone, renders the individual more susceptible. Certain people are *congenitally immune* to certain diseases, and others *acquire immunity* owing to a previous attack of the disease. Various theories have been brought forward to explain this immunity; e.g. Metchnikoff's Theory of Phagocytosis is that the white corpuscles are specially competent to devour germs in cases of congenital immunity, and acquire this power after an attack of the disease in cases of acquired immunity. A modification of this statement is the most commonly accepted theory to-day.

When germs succeed in entering the body and thereby causing an attack of disease, they attract to themselves all the white corpuscles in the neighbouring blood-vessels and lymphatics, and there ensues a struggle. In the course of this fight the phagocytes gradually devour the germs or secrete substances which dissolve them, and the result is that poisons called toxins are liberated and are carried all over the body in the blood, thus producing the symptoms or outward signs of the disease.

The symptoms increase in severity as the amount of toxin in the blood increases. Further, they may vary in severity according to the constitution of the patient. The period before the poison is in sufficient amount to produce symptoms is called the *incubation*; it is followed by the *invasion* period, when symptoms develop, and which terminates with the *climax* of the disease; this is followed either by death or by the *decline*, during which the germs are being killed off and the toxin eliminated from the body by the excretory organs; and this period is followed by *convalescence*, during which the flabby, exhausted tissues recover their normal tone.

Symptoms Common to most Infectious Diseases. (1) Rise of temperature owing to the toxin, which upsets the equilibrium between heat-production and heat-loss. This equilibrium is maintained by the Nervous System acting on the blood-vessels, and the toxin disturbs the Nervous System and so heat-balance is lost. If too much heat is produced, which is the general effect, there is general wasting of the body owing to the tissues being so quickly oxidised. In *taking temperature* one can place the thermometer in the mouth or the arm-pit, but one must read the thermometer before starting and see that the mercury is down to 98·4° F. at least. It should be read in a *horizontal* position. It is just as well to have two thermometers. *Temperature is the best test for exclusion of a child from school.* If an epidemic is about, send the child home if the *slightest* sign of abnormality appears. (2) *Rigor* is a spasm of contraction of the skin-capillaries owing to disturbance of the Nervous System. It makes the child feel very cold, but the temperature is high. (3) *Rashes* are due to loss of function in the skin and the effort of nature to cast off waste accumulated in the sweat-glands and other parts of the body. (4) Sore throat, headache and sickness occur in many infectious diseases.

Period of Infection. As a rule a disease is not infectious till the symptoms begin, and therefore if the child be isolated directly the first symptoms show, infection rarely spreads. *Measles and whooping cough* are infectious for several days before they can be diagnosed, because the symptoms are not characteristic; thus in measles the first symptom is merely cold in the head, and in whooping cough there is no cough to begin with. Hence it is more difficult to stop the spread of these two diseases than of practically any other.

The Three most Important Infectious Diseases from the school point of view: (1) Measles, accounting fo 4,249 deaths in 1928; (2) Whooping Cough, accounting for 966 deaths in 1928; (3) Diphtheria, accounting for 2,994 deaths in 1928. All these deaths were at ages below 15.

1. **Measles.** Most of the deaths occur between two and five years old, and are *due to ignorance* of the seriousness o the after-results, and to bad nursing. Fifty per cent o London children have had measles before coming to schoo (and some come at three years old). There are two fallacie that one constantly comes across in connection with measles (1) that the child *must* have it, and (2) the younger th better. Now a child need *not* have it, and the *older* the better, for then it is much less likely to die of it, and less likely t catch it, because less susceptible. Hence, keep childre away from sources of infection as long as you possibly can. The *incubation* is usually fourteen days, but *may* range fro seven to twenty-one days. *Symptoms:* For the first four day the child has a bad running cold and this is the most infectiou period, hence the spread of the disease. After four days th *rash* appears, big, coarse, blotchy, and first on the face whic looks swollen. Compare scarlet fever, in which the ras comes first on the upper part of the chest and not at all o the face, though the face is flushed. In addition there is ris of temperature and often headache and sickness. In mil cases the rash disappears in a few days and the child feels al right in a week and can get up after a fortnight, but it i *infectious for three weeks* and should be excluded for tha time.

Nursing. The child should be in a *warm, well-ventilate* room and should be warmly wrapped up, but have plenty o air.

Complications. These are very likely to develop if the cas is not properly nursed, because the disease leaves the chil very tender, and draughts and chills are liable to cause bron chitis and pneumonia. The *signs of pneumonia* are rapid heavy breathing and cough. If these appear the doctor should be sent for, for there is bound to be a fight for the child's life. The other two complications are *eye and ear discharge*, e.g. one-tenth of the deaf and dumb are so owing to measles.

Precautions in school: (1) Send home any child showing symptoms of cold, if cases have already occurred, for four days. (2) Exclude cases for three weeks.

School-closure is of very little use in towns, even in infants' schools, because the children catch the disease outside as much as inside, and infection has probably spread before closure; e.g. in Woolwich, for two years some schools closed for measles and some did not, with the result that practically the infection burnt itself out irrespectively of whether the schools were open or shut. In London, the usual procedure is as follows in the case of a measles epidemic: The infants' department may be closed, and in the other departments children from infected homes who have not had the disease are excluded. Another suggestion is to close the class or school nine days after an outbreak, for five days. Now $9+5=14$, and measles tends to occur in crops with ten to fourteen days between. Hence in the five days the new crop will arise *at home* and so save further infection in class.

Whooping-Cough. *Incubates* about eight days (the limits are seven to fourteen). Most deaths occur between two and six years. *Symptoms:* A common cold, followed in a few (ten) days by fits of coughing, ending in the characteristic "whoop" which is due to the violent intake of air into the lungs which are very nearly empty owing to the violence of the cough. The child may go blue in the face during the fit, and often vomits afterwards.

Infection lasts for six weeks. It is not likely to be conveyed in clothes.

Treatment. Keep warm and free from draughts, though not in bed. Give good food and plenty of fresh air.

Complications. The danger is that the disease may last so ong that the lungs get worn out and the child dies of lung disease, e.g. pneumonia, or consumption.

Diphtheria. The attack rate is greatest at four to five years old, and therefore if we can postpone infection we reduce the chance of the child's getting the disease, and if it does get it, the attack is less severe. The usual *incubation* is two days (the limits are one to seven). The germ attacks throat, wind-pipe or nose, either one or more of these parts.

Symptoms of throat-diphtheria. Sore throat, but not violently so ; rise of temperature, but not very high. In this connection it is worth noting that tonsillitis causes much sorer throat and higher temperature. The patient feels very ill, and a thick membrane appears on the throat, due to the growth of the germs. Paralysis of the limbs is common, but always passes off, but death may occur after the throat is quite well, owing to paralysis of the heart. The patient is never safe from this till four weeks have passed. The *heart* is the essential thing to look after.

Treatment. Antitoxin should be injected *at once*, i.e. in the first three days if it is to be of much use, and the earlier the better. It has saved many lives. There is *no* danger (e.g. of paralysis) from antitoxin and it is preventive as well as curative. The preventive effect lasts about three weeks, and so beneficial results have been obtained by inoculating large numbers in epidemics.

Preparation of Antitoxin. It is made by cultivating diphtheria germs in broth, which is then filtered, to separate the germs from the toxin which they have produced. The toxin is injected into a horse for two or three months, at intervals, with the result that the horse does not suffer, but produces a quantity of adverse material, or *antitoxin*, in its blood. It is then bled, the stuff is filtered to get rid of possible germs, standardised, and is then ready to use.

Symptoms of Diphtheria of the Wind-pipe. This usually spreads from the throat, but the larynx may be the first part attacked. The symptoms are laboured breathing and usuall a brassy cough. These may go on for hours only, or for days. Death here is due to stoppage of the wind-pipe by the membrane which forms over it—and it is a very dreadful death Tracheotomy is often necessary, i.e. a hole is made in the wind-pipe and a tube inserted, but it is not always possible Here again, antitoxin will rescue people on the verge of choking

Symptoms of Nasal Diphtheria. This disease is often no recognised, and hence is very productive of epidemics. The throat may be quite normal, but the nose is red, sore and crusted inside and about the nostrils.

Freedom from infection is only determinable by bacteriological examination of a swab taken from the throat or nose. *Relapses* often occur after discharge from hospital, and the child should not be admitted to school till a *fortnight after discharge.* This is a rule in London and many other areas. Here is one of the great uses of an inspection Clinic.

Carriers are those people who harbour the germ though appearing quite well. They may, however, eject the germ in coughing, sneezing, etc., and so infect others.

Spread of infection is largely personal in diphtheria, i.e. from child to child by the breath or by sucking the same pencil, drinking from the same cup, etc. Hence the way to stamp it out is by careful inspection and isolation of children rather than by wholesale disinfection of rooms. It is wise, however, to disinfect or destroy certain of the child's personal belongings, such as pens, pencils, books and desk. Every child should always have its own separate supply of pens, pencils, books, etc., for the use of these articles in common may spread not only diphtheria but various other diseases.

Effect of Sewer-Gas in producing Diphtheria. Certain of the components of sewer-gas have the power of relaxing the throat, so producing an unhealthy condition of the throat. They also affect the digestive tract, producing diarrhœa. Hence the throat is ready for the diphtheria germ and the intestine for the typhoid germ if they come along. See also Appendix IV.

Scarlet Fever[1] **(Scarlatina).** The greatest susceptibility is before five years old. It *incubates* usually for four days (the limits are one to seven). *Symptoms:* On the first day the child feels sick, and the throat is sore. On the second day a brilliant rash appears on the upper part of the chest. The rash consists of fine pin-spots (compare measles). The " white strawberry tongue " is a characteristic symptom for the first two days. The rash spreads over the body and usually begins to fade after a few days. By the fourth day the white fur comes off the tongue and we get a " pink strawberry tongue " absolutely characteristic of the disease. The patient feels pretty well in two or three weeks. *Peeling* usually begins in about ten days, and to stop the bits of skin flying about in the air it is well to oil the body. The skin comes off in the largest flakes on the soles of the feet, the palms of the hands and the outer edge of the ear, and if you are suspicious that a child in school has had scarlet fever and has been sent back to school too soon, these are the places to look at. The peeling used to be considered the most infectious stage, but this idea is exploded. The most infectious time is the first week, when the throat is sore and the rash is out.

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[1] Scarlet fever has become a comparatively slight disease. Thus only [illegible] children died of it in 1925 as compared with 2,5[illegible]6 in 1908.

The duration of infection is six weeks.

Spread of infection. (1) Very slight, undetected cases may give others quite a severe form of the disease. (2) Running from the eyes or ears may last for months and spread the disease wholesale.

Complications. (1) Kidney disease, hence the need of care to avoid chills during convalescence. One sign of it is blood in the urine. (2) Ear discharge. (3) Rheumatism.

Smallpox. Before vaccination was introduced, smallpox was the most fatal disease in the world. The three places in England where there have been recent epidemics, viz. Leicester, Glasgow and Gloucester, are the three places where the magistrates were most lax in enforcing vaccination. In the Gloucester epidemic, which occurred in 1895–96, *two hundred and seventy-nine* unvaccinated children, and *one* vaccinated child died. The nurses in smallpox hospitals are always vaccinated, and practically never catch the disease. Indian Army men are also always vaccinated and smallpox is very rare amongst them, in spite of the prevalence of the disease in India. Probably about fifty per cent of mothers get out of vaccination on the conscientious objection score, and so England is rapidly becoming unvaccinated, and some day we shall all suffer for it.[1]

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[1] It may justly be said that we are already doing so, for smallpox is rapidly increasing in this country. Thus there were 2,504 cases in 1923, and 12,420 in 1928. Of the cases in 1923, 83·5 per cent were unvaccinated, and taking children under ten years old, 99·7 per cent were unvaccinated. In 1928 a vaccinated child was said to be a curiosity in Northampton—and the town had 82 cases of smallpox; whereas 81 per cent of Liverpool children were vaccinated and the town had only 2 cases of smallpox. This shows very clearly the protection given by vaccination.

The *incubation* is twelve days. The *symptoms* are headache, backache, rigors, rise of temperature. On the third day the rash appears, first on the forehead and wrists, as small red spots which soon get hard, and feel like shot under the skin. These spread over the whole body and fill with water which turns to matter, each mattery head being surrounded by a red inflamed ring. In an unvaccinated person these pocks may be so close that the whole body is one mattery mass of sores, there not being a place where one can touch the patient between them. Meanwhile the temperature goes up very high and the patient is violently delirious. If a pock comes on the eye it produces blindness. In any case the person is marked with the typical " pits " for life. In the days of the Stuarts any woman who was not marked with smallpox was accounted a beauty in virtue of that fact. In the East it was considered so inevitable and so dangerous that people used to inoculate themselves with the disease from smallpox patients, because thus they got it more lightly, and the practice was introduced into England by Lady Mary Montagu.

So matters stood till Jenner discovered *vaccination.* He was the son of the vicar of Berkeley, in Gloucestershire, and was born in 1749, and his grave can be seen in Berkeley church. The district is typically agricultural, and Jenner noticed that dairymaids and anyone else who had much to do with cows suffered from a disease called cowpox (Vaccinia) which they caught from the cows, but that they very rarely caught smallpox. This suggested to him the idea that cowpox protected a person from smallpox, and hence that it would be a good thing if everyone had cowpox, which was a quite slight disease. So he started the idea of vaccination, i.e. of injecting some of the watery fluid from the blebs which occur in cowpox into human beings. Now, in those days, antiseptics and disinfectants were unknown, and the idea of sterilising surgical implements and of cleanliness as we conceive it was also unknown, and so many accidents occurred in the early cases of vaccination, owing to the introduction of dirt and other germs during the operation. Thus blood-poisoning, etc., sometimes resulted, and hence a good deal of criticism was directed against vaccination. However, as time went on, methods improved, and now there is no danger of poisoning or of the introduction of tuberculosis or other diseases. This has been partly brought about by the doing away with the old method of vaccinating one child from another. Nowadays the vaccine is got from a calf kept in a Government laboratory. Vaccination effects complete protection for about seven years and partial protection for life. If two vaccinations were compulsory, say at birth and twelve years old, as they are in Germany, we should be almost completely protected for life. Smallpox is almost unknown in Germany.

Chicken-pox. Incubates from twelve to nineteen days. *Symptoms:* The child often does not feel ill at all, and the first sign is the *rash*, which comes first on the body, and consists of red spots which quickly turn into vesicles, or watery blebs, which dry off into scabs in a few days. The scabs fall off in about a fortnight. *Infection* lasts for at least three weeks, or till all the scabs are off.

Mumps. Incubates from seven to twenty-one days. The germ attacks the salivary glands, chiefly the parotid, i.e. the glands at the angle of the jaw, in front of the ear, and usually one side is attacked before the other, producing a wide smooth swelling. It may also attack the sub-maxillary and sub-lingual glands, giving fold on fold of "double chin." The swelling subsides in a week or a fortnight. It can be distinguished from the swellings due to toothache or swollen lymphatic glands because these are both much more local.

Infection lasts at least three weeks.

The *chief cause of the spread* is the child who is sent back after four or five days by the mother, who says it has had bad toothache.

Treatment. Keep warm and away from others. Young children can stay in bed a few days.

German Measles. Incubates from fifteen to eighteen days, usually. (Extremes are ten to twenty-one days.) Usually a rose-red flush on the face is the first symptom. Enlargement of the lymphatic glands at the back of the neck is very common. There is usually slight headache and often slight cold in the head. Infection lasts three weeks.

Infantile Paralysis. This is due to a germ which is supposed to be carried by the stable-fly, which breeds in stable manure. Hence the desirability of regulations as to (1) the keeping of such manure in covered receptacles so as to exclude flies and prevent them from breeding, and (2) the frequent removal of the manure. It occurs chiefly in children under six. It begins with a feverish cold, like measles. In the mildest form the muscles become very weak for a short time, but paralysis usually sets in, either temporarily or permanently. Small groups of muscles only may be affected or one or more limbs may be rendered helpless. The disease is infectious in the early stages, for about a month, and therefore children should be isolated, and among the poor they should be removed to hospital. Contacts should be excluded from school.

Influenza. (See Appendix III, p. 326.)

Sleepy Sickness. (See Appendix III, p. 326.)

CHAPTER XIX

PHYSICAL DISABILITIES (*continued*)

Tuberculosis. In England and Wales there were 36,623 deaths in 1928 from tuberculosis, i.e. about 1 in 13 of all deaths are due to this disease. Only comparatively recently has it been recognised as infectious and due to a germ, the tubercle bacillus, a little rod-shaped plant. It is essentially a disease of civilisation, where there are several varieties of germ, of which the human and the bovine are the most important. Twenty-five to thirty per cent of cows are tuberculous in this country. These do not all necessarily give tuberculous milk, for, as a rule, the disease must attack the udder for milk to be tuberculous. However, about ten per cent of all samples of milk are tuberculous; e.g. Liverpool, in 1912, showed 7·4% of milk samples with the tubercle bacillus; Manchester, in ten years, showed 8·1% of milk with the tubercle bacillus; Birmingham, in 1912, showed 19·6% of milk samples with the tubercle bacillus; and Edinburgh showed thirteen to twenty per cent of milk samples with the tubercle bacillus. Further, human beings are susceptible to the bovine bacillus, and in children a good deal of tubercle is due to this type of bacillus attacking glands or bones. In children these types of tuberculosis are much commoner than lung-tubercle (phthisis), whereas in adults the reverse is the case. Phthisis is always due to the human bacillus.

Susceptibility. Post-mortem examinations show the enormous extent to which we all take in the germ of tubercle and lodge it temporarily, at least; e.g. in one series of observations, eighty-five per cent of hospital post-mortems between ten and eleven years showed tubercle, but it was mostly healed; that is, most of us are infected at some time or other, but the majority recover without ever being aware of the fact.

Types of Tuberculosis. The germ may attack pretty nearly any part of the body : e.g. (1) *The lungs*, producing phthisis. About one in two hundred children suffer from this. (2) The bones, producing struma, which causes spinal curvature (acute backward) ; hip disease, knee disease, etc. This form of the disease is by no means uncommon, tending to swollen joints which break down owing to the action of the bacillus on the bone and discharge pus, and often the end is loss of use of the joint. *N.B.*—Mothers often say that hip or spine disease is due to a fall, but usually there has been no such accident really accounting for it. (3) *Lymphatic glands* (producing scrofula), especially the glands at the side of the neck. Chronic swelling or suppuration of these is usually tubercular. (4) *Eye.* Many chronically inflamed eyes are tuberculous. (5) *Ear.* (6) *Brain*, producing meningitis. (7) *Skin*, producing lupus. (8) *Intestines.* About two per cent of children suffer from forms two to eight, so that phthisis is by no means the commonest form in children. In addition we have ten per cent of children who are classed as *pre-tuberculous*, and these largely coincide with the children suffering from malnutrition. In fact, one writer says, " Malnutrition *is* tuberculosis." This is going far, but at any rate these ill-nourished children are potential if not actual harbourers of the tubercle bacillus.

Symptoms of Phthisis (Lung-Tubercle). Cough, loss of weight (hence one reason for taking the weights of school children), the child looks ill and out-of-sorts, has a pretty pink flush, slight rise of temperature, quickened breathing, unnaturally bright eyes, after a time expectoration with the cough. This is full of germs, which float in the air when dry.

Cause. Usually the disease arises from living in the same house with a consumptive who is careless about expectoration. Families are often decimated in this way. The next most important cause is the inhaling of the germs in stuffy public buildings (theatres, picture palaces, etc.), and in trams, trains, and the street.

Treatment has been revolutionised within the last few years, with the result that the death-rate is now declining, and very largely owing to the work done by teachers in the elementary schools.

1. The first thing to emphasise is the iniquity of the consumptive spitting about, and the only practical way to do this is to demand (*a*) that nobody shall expectorate in streets, trams, halls, etc. Hence the notices one sees in such places; (*b*) that the consumptive shall expectorate into a special cup or flask or into a handkerchief of so little value that it can be burnt, and not washed.

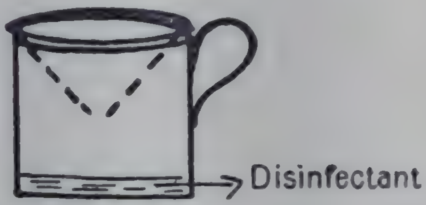

Fig. 68. Expectoration cup for use indoors

The funnel can be removed, so that the cup can be easily cleaned

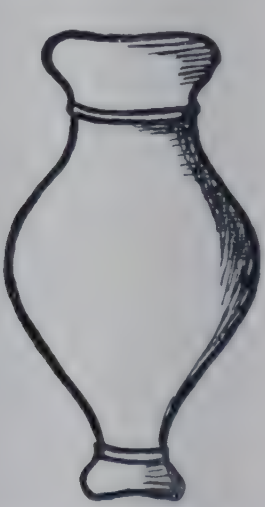

Fig. 69. Expectoration flask for use out-of-doors

The flask is flattened, so that it easily goes into a pocket and can be taken out and concealed in a handkerchief. It has a screw stopper at each end, so that it is easily cleaned

2. The second point to teach is the need of fresh air. A few years ago more soldiers and sailors died of consumption

than did men of any other calling, and on investigation it was found that they slept in very crowded quarters with windows shut, and the thing was remedied in eighteen months by enlarging the sleeping-quarters and keeping the windows open. Consumption is now *rarer* in the Army and Navy than in any other calling. If one can only get a person to keep the bedroom window open for a fortnight, he rarely goes back to keeping it shut.

3. The third point is the need of good food; (1) is for the sake of the community; one can live quite safely in the same house as a consumptive who is careful; e.g. nurses in Consumptive Sanatoria rarely catch the disease, but any patient who expectorated carelessly would be promptly turned out; (2) and (3) are for the sake of the individual himself.

Sanatorium Treatment. The Finance Act of 1911 made £1,500,000 available for provision of Sanatoria and other institutions for the treatment of tuberculosis in the United Kingdom. Of this amount £100,000 was ear-marked for sanatorium schools for children. The distribution of these grants rested with the Local Government Board. By agreement with them the Board of Education approved the plans and arrangements for the education of the children. Sanatorium treatment is very expensive and it must be prolonged (say for three years) to effect cure. It is doubtful if we have not been regarding the sanatorium in the wrong light hitherto, i.e. as a place for *curing* tuberculosis, and whether its true function is not to *educate patients to live the right kind of life at home.* Anyone can do it, given a bit of garden, a shelter and good food, and if we consider the sanatorium in this latter light, a short stay (e.g. three months) will suffice, and the problem presents nothing like so vast a difficulty as it has hitherto done. In the case of children, if they *do* go to a sanatorium, it should be combined with a school; so that the children do not fall hopelessly into arrears educationally, and in practice they are found to be much happier when they have lessons than when all day is on their hands. In 1928 we had twelve day and eighty-five residential sanatorium or hospital schools for children suffering from tuberculosis, either pulmonary or surgical. This does not include the *open-air* *schools and classrooms*, of which sixty-two day and thirty-eight residential exist, because these usually only take pre-tuberculous children or children recovering from tubercle, not actually diseased children. In the sanatorium school lessons are shortened to half the usual length, but the children, as a rule, keep up with their standard. Everything is done in the open air. But more and more people are realising that the child who pays best for special school treatment is the *pre-tuberculous.* It is much easier to prevent than to cure tubercle. Hence these pre-tuberculous cases should have the first claim to any open-air education existing. (See Chapter XXVI.)

How to Prevent Tubercle Attacking Bones and Glands. This would largely be effected if all milk were sterilised, and still more if tuberculous cows were weeded out.

Heredity. The disease is not hereditary, but the *tendency* is strongly so. Hence the risk if consumptives marry.

Infection in School. From this standpoint tubercle can be divided into "open" and "closed." About one in five hundred cases are "open," i.e. there is some kind of discharge, e.g. cough and expectoration, or mattery discharge from an abscess in a gland or bone. Such children or teachers should be excluded. The "closed" cases show no discharge and are therefore not infectious.

CHAPTER XX

NERVOUS CONDITIONS

Chorea, epilepsy, hysteria, stammering.

1. **Chorea** (St. Vitus' Dance) is of great interest in school hygiene. It is, for all practical purposes, rheumatism of the brain and often leads to heart-disease, like all forms of rheumatism. It is much commoner in girls than in boys. It rarely occurs before seven or after fourteen.

Symptoms. The first is often suddenly developed fidgets and clumsiness. The tongue is a good indicator; on asking the child to put out the tongue, one sees that it jerks and is out of control. As the disease progresses, the child is never at rest, some muscles are always moving, and the brain shares in the jerkiness of the body, i.e. it is unable to concentrate attention, and headaches, etc., result.

Treatment. Open air, good food, rest and especially absence of all nervous excitement. Hence the child should not be in school. If taken in time it can usually be cured in a few weeks, but occasionally it continues for years. When the child returns to school, do not press it.

The cause may be fright or other emotional disturbances, overwork, etc.

2. **Epilepsy** is due to an irritable and unstable brain-cortex. It is strongly hereditary and "many are also said to give the reaction for syphilis" (Kerr), therefore epileptics ought not to marry. Gowers found that fifty per cent of the descendants of epileptics were epileptic. Also, instead of being epileptics, they may be mentally deficient, i.e. considerably more than fifty per cent of the descendants are *either* epileptic or mentally defective. There are two types of epilepsy: *Major* and *Minor.*

Symptoms of Major Epilepsy. Momentary palsy of th face, then sudden unconsciousness, stiffening of the bod convulsions for two or three minutes, during which the mov ments of the jaw work the saliva up into froth, so that th person "foams at the mouth," and *may* bite the tongu The limbs work convulsively, and the face is distorted an blue. This is followed often by half an hour's unconsciousnes or sometimes merely by drowsiness. After unconsciousnes has passed off the person is often "off his head" for an hou or two and therefore should not be left, because he may g out and drown himself, etc.

Treatment. Lay the person on his back, get furnitur against which he may strike himself out of the way, put something, such as the lid of a pencil box between the teeth t prevent the tongue being bitten (some doctors consider thi unnecessary), and do not restrain the movements of th limbs more than just enough to stop injury, for if held dow rigidly the muscles may tear under the strain. *Diet* is im portant, the best being an exclusively milk diet, or one wit very little meat and that well-cooked and minced, to avoi irritation to the nerves from the bolting of big pieces. A Lingfield Colony, where there are 126 children, the diet chiefly vegetarian. The *drugs* usually prescribed are bromide

Education. Eighty per cent of epileptic children are unf for the ordinary school for the following reasons: (1) The are generally dull, even in facial expression. (2) They ar often unduly emotional (especially smiling). (3) Speech usually indistinct and defective and acquired late. (4) Fi occurring in school place undue strain on the teacher and th rest of the class. On the other hand, it is very importan that these children should be educated, to stop the ment deterioration which usually sets in. At present six epilept schools exist, accommodating 500 children altogether. The should form parts of a *Colony*, providing plenty of outdo work, but, of course, preventing marriage. Apparentl 6,430 epileptic children exist, excluding London, in Englan and Wales.

The *symptoms of minor epilepsy* are slight and transitor the fit being a wave of unconsciousness only producin momentary interruption of occupation. The child goes white, gets rigid for an instant, then goes on as usual, but he *may* do some irresponsible action, such as hitting his neighbour without cause. If the fit occurs whilst the child is riding a bicycle, say, he may fall off. The *results* are as serious as those of the major type, if not more so. Some authorities state that this form is more often associated with mental enfeeblement than is the major, and is less hopeful.

Psychasthenia, Neurasthenia, and especially Hysteria are probably the typical nervous disorders of women, says Mr. Havelock Ellis, in his interesting book, *Man and Woman*. The two former are a large collection of vague nervous symptoms which not all authorities reckon as a definite disorder. " The symptoms are, generally speaking, a weakness of the Nervous System—including both brain and spinal cord—due partly to insufficient or inappropriate nutrition and partly to faulty development, showing itself by a tendency to over-action and irritability of the Nervous System, morbid sensibility and mental anxiety, etc." " The neurasthenic condition is the soil on which organic nervous diseases may grow . . . and we find it with special frequency in both men and women who overstrain their brains, in artists and writers and those who are over-strenuous in social movements."

" *Hysteria*, which is one of the chief of the more definite diseases to which neurasthenia may lead, has no necessary connection with this kind of mental tension. It occurs with much greater frequency among those whose nervous activities are unemployed." Hysteria affects the whole Nervous System, and specially the brain, and in it, *response to suggestion*, which is a normal character of all nervous tissue, is so heightened that it becomes irresistible and may be aroused by the faintest suggestion from without or within. Sydenham says that there are very few women except those leading a hard and laborious life who are entirely exempt from hysteria. Kraepelin states that seventy per cent of women are hysteric. Hysteria is specially common in emotional girls at the age of puberty. *Symptoms*. Emotional outbursts, morbid sensations (ball in throat, etc.). The fit starts gradually, with crying, laughing, or other emotional display ; then the girl falls with a scream and seems convulsed and insensible; but one need not fear injury in falling, for always she has "one eye open" to note the effect on the audience. An intense desire for sympathy is very characteristic.

Treatment. Give no sympathy, turn out sympathisers; speak severely and tell the girl to behave sensibly. If this has no effect, leave her alone and the fit always stops pretty soon.

Stammering. This is essentially a nervous disorder, due to excessive attention to the mechanism of articulation, i.e. to muscles of mouth, tongue, lips, etc., and lack of attention to the respiratory mechanism. This results in an overflow of nervous energy from the articulatory muscles to others not directly connected with speech, and so accounts for the facial contortions and jerkings of head and limbs often observed in stammerers; meanwhile speech is attempted with half-empty lungs, and so we get spasmodic stops, repetitions, etc.

This state of affairs may be due to various causes: e.g. to general shyness and nervousness, to a neuropathic heredity, or to shock. Imitation plays a considerable part in causing stammering, and again, stammering often begins after an acute attack of infectious disease, and in some cases it seems to be associated with the presence of enlarged tonsils or adenoids.

Boys stammer much more than girls, in the proportion of three to one, and often the condition becomes much more severe between the ages of eleven and fourteen. "In severe cases the condition of the patient is one of great embarrassment and even misery. This attitude of the patient towards other people is often out of all proportion to the severity of the case, and in many cases timidity seems to be the underlying characteristic, and to form indeed the basis on which stuttering arises."

Treatment. This is sometimes easy and sometimes very difficult, but, in practice, many cases respond to class-treatment of the right kind. Such treatment should aim at three essentials, namely (1) attention to the general health, including such conditions as malnutrition, anæmia, decayed teeth, adenoids, overstrain, constipation, lack of fresh air and exercise; (2) attention to the mental condition, which is often very unstable and restless and lacking in self-control.

Here one must try to develop self-control, belief in the teacher and in the possibility of cure. (3) The third essential is treatment of the actual defect, and here many methods have been tried, and many have had some amount of success in spite of themselves, so to speak, and owing to the fact that suggestion and confidence in the teacher play a large part in the cure of stammering. However, in school, the methods used aim at restoring the right balance between the supplies of nerve-energy sent to the respiratory and articulatory muscles. Hence the child is given certain respiratory and vocal exercises in class once or twice daily. The best known vocal exercises are those of M. Leon Berquand. The children are collected into classes of ten to fifteen for a six weeks' course, during which the special exercises occupy three-quarters of an hour to one hour both morning and afternoon, the rest of the time being given to ordinary school work. For the first fortnight the children are not supposed to talk either in school or at home. They are given books—in which to write what is necessary.

The result is that usually, after a six or eight weeks' course, the children can both read and speak without stammering, but a good many relapse unless the treatment is kept up at intervals, say by Saturday classes, or by a yearly and longer repetition of the treatment.

With regard to slight cases, treatment can often be given in the ordinary school, if only the class teacher will insist on the child's speaking slowly and beginning every sentence with the lungs full of air.

CHAPTER XXI

HEART DISEASE[1] AND RHEUMATISM

HEART disease has important bearings on school life and subsequent employment. It may be what is called *organic*, i.e. involving actual defect in structure of some part of the heart, or it may be *functional*, i.e. the working of the heart may be abnormal. Also, it may be congenital or acquired. If it exists before four years old it is congenital. *Organic* disease is chiefly due to rheumatism. *Functional* irregularities are chiefly due to instability of the heart in childhood.

Prevalence. The Reports of School Medical Officers for 1915 give one to five per cent of children as having heart disease. Taking five per cent, this means about a quarter of a million children. In some districts higher returns are made, e.g. fourteen per cent in one place, and nine per cent in Leeds, and these divergences suggest that the doctors are not giving enough attention to the subject, which is a very important one because it is so necessary to try to remedy such a disabling condition ; e.g. to decide if the child should be away from school altogether or be at a special school.

Points to bear in mind with regard to Heart Disease in School Children. (1) Serious heart disease means absence from school, and therefore the worst cases do not appear at medical inspection. (2) Heart disease in children differs from that in adults in several ways : e.g. the child's heart and circulatory system are growing and more susceptible to changes. Thus it is less stable and regular than that of the healthy adult, and the same applies to the Nervous System controlling it. Both respond readily and quickly to any body disturbance. (3) Every case of heart disease must be treated individually. It isn't like a case of decayed teeth or adenoids, where the treatment is much the same for all, but the right handling of a heart case involves many considerations, such as preventive measures against rheumatism, rest, adaptation of the school curriculum, carefully supervised personal hygiene ; e.g. in Tunbridge Wells, the Education Authority has a printed leaflet on rheumatism which is distributed to the homes of children with heart disease, whenever it is considered advisable. It is as follows :

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[1] See Report of Chief Medical Officer of Board of Education for 1915.

"Rheumatic attacks in children are very easily overlooked, as the outward symptoms are usually quite trifling and likely to escape the notice of parents. At the same time, these slight attacks may permanently damage a child's heart and produce very serious results in later life. Hence it is very important that treatment should be secured immediately for rheumatism in its earliest stages and mildest forms. *Symptoms which suggest that a child is suffering from the rheumatic poison :* (1) Growing pains, especially pain in the ham-strings. (2) Repeated sore throat or tonsillitis. (3) Attacks of irritability, night terrors, twitching of the face or fingers, or clumsiness in children not usually troubled in these ways. (4) Certain rashes (e.g. spotted rose-rash, nettle-rash, etc.). *Precautions that should be taken with rheumatic children :* (1) Keep *limbs* and body warmly but lightly clothed, preferably with woollen underclothing. (2) Put child to *bed* and obtain medical advice whenever feverishness, growing pains, sore throat or other symptoms of rheumatism are noticed. (3) Enlarged tonsils are better removed if a child suffers from repeated sore throat."

Croydon also issues a leaflet.

Rheumatism. In view of the important part which this disease plays in producing heart disease, I propose to discuss it rather more fully. The first point is that rheumatism is due to a germ or a group of germs ; it is an infection. Dr. Langmead says that at children's hospitals it is recognised that there are three infections of paramount importance, those of pneumonia, tubercle and rheumatism. The *hereditary tendency* to rheumatism is very marked. The poisons of the disease seem to so permeate the parent's tissues that the child's tissues are made very liable to attack, especially, o course, if both parents are rheumatic.

How the Germ gets in. Many authorities attach grea importance to the *tonsils* as the avenue of invasion, an probably the cases of rheumatism following infectious fever are the result of the germs getting into the system durin the sore throat period that usually occurs in these fevers Hence in cases of enlarged tonsils it is advisable to have the operated on *as a preventive* against rheumatism, as well a because they interfere with nasal breathing and bring in thei train all the various ills due to mouth-breathing.

Effect of Environment. Cold and damp houses and sur roundings favour the disease, especially the form of it whic attacks the joints (arthritis), producing swollen and sti joints. Also they greatly militate against recovery. Change able temperature is also bad.

Symptoms which should make one suspect Rheumatism[1] (1) Heredity, i.e. presence in parents. (2) Anæmia is constant associate of rheumatism. (3) Growing pains especially about the ham-strings. (4) Frequent sore throats (5) Nervous children are frequently rheumatic. (6) Rashes such as spotted rose-rash and nettle-rash. (7) Dilated heart (8) Chorea, which is brain rheumatism.

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[1] See *School Hygiene*, Feb., 1915, Discussion on Rheumatism.

CHAPTER XXII

TEMPERANCE

Methods of teaching—Knowledge alone insufficient—Board's syllabus of lessons on temperance—Alcohol: chemical and physical properties, preparation, percentage in beverages, effects on the body and brain, effects of intemperance on individual, home and State.

Methods of Teaching. The Board of Education suggests that at least three lessons be given yearly and fairly close together, but there is probably not much sense in beginning under ten. At any rate, if one does begin under ten, the teaching must only be of a very general and broad kind. The evil consequences of intemperance should only be taught to children over twelve. The subject of Temperance should be part of the Hygiene teaching, not isolated into a mysterious and horrible watertight compartment. This is one reason why it is best given by *a member of the regular staff* and not by an outside temperance lecturer, as has sometimes been done. Another reason is that the "Temperance Lecturer" is given to being lurid, and to rather unscientific statements and arguments which cannot exactly be proved, and the result sometimes has been more harm than good, for the child has gone home, repeated the exaggerated statements as to the results of drinking a glass of beer, and the parents, who may be *temperate* users of alcohol, are naturally annoyed and vent their annoyance on the child and on the school, pouring contempt on the teaching and doing all they can to belittle it to the child. Hence one wants to avoid *intemperate teaching of temperance*, and to teach temperate use of *everything*, including food and drink, as a part of *general self-control*; and here it is well to remember that one can be intemperate in the use of other drink besides alcohol. Many women ruin their health by excessive tea-drinking. Now, the question of *self-control* is about the most important one there is in relation to any life. It depends on the amount of inborn will-power and on the training of that power, as we said in an earlier lecture, and on it depends very largely the career, success or failure, of the owner. As a matter of fact, a large proportion (sixty-three per cent) of habitual drunkards are so because they are mentally deficient and have that outstanding characteristic of the mentally deficient, viz. weak will. This statement has the authority of Dr. Branthwaite, Inspector under the Inebriates Act. It follows that many chronic inebriates should be treated for mental weakness, not as criminals. To return to the question of teaching temperance, note that the word used is temperance, not total-abstinence. Now certain writers argue that *all* use of alcohol is bad, but whether that is an entirely justifiable statement is doubtful. It can, however, be safely said that alcohol is not a *necessity*, except in certain illnesses, and even there it is less used by doctors than it used to be. On the other hand, at present the public-house stands to the labourer in place of the club and the café to a different social group, and if one is going to tell the so-called working man that he must give up beer, one ought to provide a substitute. Now our cafés and tea-shops, as they stand at present, are not attractive to nor suited to the working man—any more than are a good many of our churches. Yet one must face the fact that he needs a place where he can get food and drink with some stimulant property when he is tired—just as he needs a place where he can get food for his soul. Our reformers should see to the provision of both of these needs, before they demand prohibition of alcohol, or wonder at the emptiness of some of our churches. The complexity of the temperance question is well expressed in the following quotation from Peabody's *Jesus Christ and the Social Question.*

"A striking illustration of this expansion and transformation of one social question into other forms is to be found in the later developments of the so-called *temperance cause.* Here is a social movement which has been very generally regarded as an isolated and specialised work. A few obvious remedies have seemed sufficient to meet the portentous evil of the drink habit. The pledge of abstinence, the prohibition of sale, the physiological instruction of clerics, the constant agitation of public sentiment, these and kindred methods of direct reform have appeared to bound the sphere of temperance work. More and more, however, it has become evident that, beyond these specific agencies of reform, there are, on every side of the temperance question, influences and movements which are among its most threatening enemies or its most powerful allies. Domestic, economic, even psychological and racial conditions are intimately correlated with the problem of drink. Is it drink which destroys the family or is it the disordered family life which tempts to drink ? Is the drink habit a morbid passion, or is it in many cases a normal and healthy craving for recreation which drives men to the saloon ? Is it true, as one distinguished economist has said, that the thirst for liquor among working men is not so much a question of drink as of food, and that to know why a poor man drinks one has but to look in his dinner-pail ?

Is it drink which robs men of their earnings, or is it the fluctuation of earnings which drives men to drink ? Would the drink traffic be less pernicious if wisely converted into a municipal industry ? Is the moral tone of the community weakened by prohibitory legislation ? How does it happen that the wine-drinking peoples of South Europe are temperate and the ale-drinking Anglo-Saxons intemperate ? These are but indications of the varied enquiries which now confront anyone who looks below the surface of the problem of temperance. What seemed to be a detached question concerning a personal habit is in fact correlated with almost every movement of social or economic reform.

The most effective attack upon the drink habit may come of some flank movement, in the interest of better homes, or healthy amusement, or regular work, or nourishing food, or State control, or the education of a new and superior desire. . . . Temperance reform is but a labour of Sisyphus, and the burden it desires to remove rolls back on the community again, unless the agitation is constantly directed, not so much to the hampering of a trade, as to the disciplining of a passion. The drink habit is in very large degree the perversion of the most universal of human desires, the thirst for exhilaration, recreation and joy, and to remove the only available means for satisfying this normal craving without providing adequate substitutes, is like blocking the channel where a stream does harm without observing how many new fields the same stream is likely to devastate."

Will Knowledge alone produce Temperance ? Remembering what we said just now about the need of a strong will, and remembering also that will is inborn, though it may be strengthened by training, and further, that we are born with very unequal amounts of will, it is probable that knowledge alone will not suffice to make humanity temperate. Most of us *know* it does not, in actual practice, for there are various things that we know bring bad results, and that we yet go on doing. Hence one needs to back up knowledge with the stiffening that one can only get from religion—which can provide sufficient driving force for even the weak-willed. If you once convince a person that his body is the Temple of the Holy Ghost, he is not likely to make a beast of himself either with drink or with any other form of self-indulgence, and there *are* considerably worse forms of intemperance than the alcoholic form.

Total Abstinence. My own feeling about this is that it must depend on (1) whether your own health requires it ; (2) whether you live in a community where alcoholic excess is fairly common, and where the example of your total abstinence is likely to help matters. That is, I think, quite clearly the teaching of Christianity. "All things lawful, but all things not expedient."

Subject-matter. In the set lessons on temperance, it is best to follow the "Syllabus of Lessons on Temperance,"[1] issued by the Board of Education, price 2d. *Section I* deals with eating and drinking : food and its use. (See Chaps. VI. and VII.)

Section II deals with *alcohol* and its effects on the body.

Characteristics of Alcohol. It is a colourless liquid, boiling at 78°C. and freezing at – 130·5°C. It burns with a nearly colourless flame, leaving no ash, and giving off carbon dioxide and water; hence its use as a fuel. It evaporates quickly, hence the cooling effect of eau-de-Cologne. It is hygroscopic, i.e. absorbs water easily. It hardens proteids because it coagulates them, e.g. (1) if you add alcohol to the white of a raw egg, the albumen becomes hard and opaque; e.g. (2) put absolute alcohol on the lips, and they go pale and corrugated, because the alcohol absorbs water from them and coagulates the proteid in the cells, so that the contents shrivel. This also explains why alcohol is useful for pickling and preserving specimens. It dissolves various substances insoluble in water, e.g. resins. Hence its use in manufactures, etc.

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[1] Revised in 1920, and now issued under the title *Hygiene of Food and Drink*

Preparation. Alcohol is made by the fermentation of sugar, obtained from fruit juice (e.g. grapes, apples, pears), or from starch in the form of grain, potatoes, etc., which is first converted into sugar and then the sugar is fermented. Fermentation is due to the growth of a microscopic plant called yeast in the liquid. The yeast feeds on it and alters the sugar into carbon dioxide and alcohol. The carbon dioxide is given off as gas. The alcohol is got from the solution by distillation. When starch is the source of the alcohol, the conversion into sugar is effected either by boiling with dilute acid, or by another fermentation process which occurs spontaneously if grain be kept moist and warm, so that it begins to sprout. The germinating grain is called malt.

Percentage of Alcohol in various Beverages. Lager beer, about four per cent; bottled beer, about seven per cent; claret, hock, etc., about nine to ten per cent; port, seventeen to twenty-three per cent; spirits: gin, thirty-seven per cent; rum, whisky, and brandy, forty to fifty per cent.

Effects of Alcohol on the Body. The amount of alcohol needed to produce these effects varies with the individual, but the latest investigations show that moderate doses have no ill-effects on a normal person, so long as they are not taken so frequently that the percentage of alcohol in the blood keeps above a certain limit, as is the case in chronic alcoholism. Alcohol may be regarded as a food, inasmuch as it is oxidised in the body, and so gives heat and energy; and the rapidity with which this happens makes it useful in certain diseases.

It should, however, be taken *with* food and not in a concentrated form. These conditions are fulfilled in the wine-drinking countries of South Europe, where intemperance is much rarer than in England. The *habitual toper* by fifty always shows more or less of the following symptoms :

(*a*) *The Cell.* The chief effect of alcohol is on the Nervous System, and the cells of the brain and spinal cord may therefore be expected to show changes, and they do. A nerve-cell normally contains in its protoplasm little spindle-shaped bodies which give it a granular look, and the protoplasm if active can take up stains. In the alcoholic subject, the cell is swollen, the nucleus pushed to the border, the spindle-bodies are no longer clearly defined and vacuoles (or spaces) are present. The cell has no or little power to take up stains. Similar changes occur in the body cells, with the result that the drinker tends to get fat and bloated. The swelling of the cells is due to oil globules developing in them and finally oil may completely replace the protoplasm, producing "fatty degeneration." Later on the cells shrink and the fibrous supporting tissue of the whole organ increases and tends to contract, and the result is that the heart has harder work to pump the blood through the shrunken organ. Hence there is undue strain on the heart which often produces heart disease, and so death, which should be ascribed to alcohol, though it never is.

(*b*) *Effect on the blood.* Alcohol decreases the oxygen-carrying power of the red corpuscles. Hence there is insufficient oxygen in the body to oxidise the food. Hence there is insufficient heat and energy, i.e. the person is chilly and lethargic. It also decreases the power of the white corpuscles to devour germs, therefore there is greater liability to catch infectious diseases—and to die of them when caught.

(*c*) *Effect on warmth of the body.* A dose of alcohol distends the skin capillaries, which consequently fill up with blood drawn off from the internal organs. This means that the skin flushes, and we have a comforting sensation of warmth, owing to the effect of this extra blood on the nerve-endings in the dermis. However, under these conditions the skin gives off heat faster to the air, and so, on the whole, heat is lost, in spite of the fact that the alcohol does produce a certain amount during its oxidation in the body.

(*d*) *The effect on digestion* is due to several things: (1) Alcohol coagulates proteids and therefore hardens them and makes them less easy to digest. Cp. egg raw and cooked. (2) It produces an increased blood supply to the stomach-lining and therefore increased gastric juice. (3) It produces increased flow of mucus also, which is bad for digestion, and (4) is followed by the crinkling-up of the stomach lining and a decrease of gastric juice. (5) The liver is congested in early alcoholism and later contracts and the surface gets knobbly owing to the growth of connective tissue. Hence the liver cannot do its work. (6) The kidneys suffer. The total effect is indigestion.

(*e*) *Effect on growth.* Children are much more sensitive to alcohol than adults, and a good many infants are given it daily, and a still larger number get it occasionally. It stunts both mind and body, and there is absolutely no question about the need of total abstinence for children.

(*f*) *Effect on capacity for work.* Excessive drinking, since it weakens the heart and muscles, necessarily reduces capacity for work; e.g. (1) Sir F. Treves in the South African War found that soldiers who drank much were the first to fall out on a long march and were less able to stand hardship than those who were temperate or abstainers. (2) Athletes in training for sports avoid alcohol.

(*g*) *Effects on the Brain.* These being more important than any of the body-effects, are placed last.

Alcohol is essentially a narcotic, *not* a stimulant, and it affects the brain with extreme rapidity, acting first on the highest centres, i.e. the self-critical centres, and those governing memory, attention, reason, judgment and the other higher intellectual functions. Later, it affects the lower centres of the cerebellum, and then co-ordination of muscular action becomes impaired, the gait becomes unsteady, the hand shakes, and so on. Finally the vital centres in the medulla are affected, i.e. those controlling breathing, the beating of the heart, and so on, and in this stage of "dead-drunkenness" the patient is likely to die unless prompt measures are taken to restore him.

However, to return to the first effects of alcohol, it is often said that exhilaration is one of the earliest results, but this is really only a case of paralysis or deadening of the self-conscious and self-critical centres in the brain, and the corresponding unchecked action of the emotions. The drinker is more easily amused, depressed, etc., by trivial occurrences, and he ceases to realise true dangers, difficulties, and causes of anxiety. This is bad, except in the comparatively few cases where relaxation of nervous tension is needed, as, for instance, a soldier needs it, on coming out of the trenches. However, the effect on the brain is extremely variable, and in *some* cases the brain seems to escape. Probably one of the chief attractions of alcohol is the false sense of freshness, of freedom from care and anxiety and worry and of general well-being which it imparts, and there is a type of highly strung nervous temperament to which alcohol is therefore a great temptation.

Section III. **Evil Consequences of Intemperance to the Individual, to the Home, and to the State.**

Excess of alcohol not only has the bad effects on the individual mentioned in the last section, but it has still worse effects, it may mean *moral* injury to himself and great harm to other people. Excess means gradual loss of self-control, and since it also originates in a lack of this commodity, children should be disciplined in such a way as to strengthen will and character. The *consequences* include: (*a*) *Waste of money* which might be saved, or spent more wisely. Often the family goes short of food, clothes, fire, doctor, etc., in order to pay for alcohol. There is no chance of improving the conditions of life, no margin for the "rainy day." (*b*) *Loss of self-respect*, carelessness about appearance, cleanliness, clothing, truth, industry. (*c*) *Loss of employment, pauperism.* The drunkard becomes idle, useless, a loafer, finally merely a burden on the rates. (*d*) *Neglect of duty*, leading sometimes to serious consequences for others, e.g. signalmen, taxi-drivers, etc. (*e*) *Ruin of the home*, which becomes more and more unhappy, poverty-stricken, etc. This is worse if the *mother* is the drunkard, because the children are more neglected and she often drags the man into the habit also. One must remember here, too, the power that the wife often has of keeping her husband out of the public-house if she can make the home comfortable. (*f*) *Harm to the State.* "One degraded or ill-conducted worker will demoralise a whole family; one disorderly family inexplicably lowers the conduct of a whole street; the low-caste life of a single street spreads its evil influence over the entire quarter; and the slum quarter . . . subtly deteriorates the standard of health, morality and public spirit of the whole city." (Mrs. Sydney Webb.) Paupers have to be maintained by the public and this means less money for the tax-payer. The prosperity of a nation depends on its workers, and if many of these are incapable, the whole community suffers.

In conclusion let us remember that more will be accomplished in school incidentally and through the general standards and personality of the teacher than through the set lessons, useful as these may be.

As regards the literature of the subject, by far the best brief discussion is that given in the little book recently published by the Liquor Control Board, and entitled *Alcohol. Its Action on the Human Organism.* (Price 1s. from H.M. Stationery Office, London, S.W.)

CHAPTER XXIII

THE SCHOOL BUILDING AND ITS SURROUNDINGS

Conditions of a healthy school: site, playgrounds and their possible uses, types of building, warming, lighting (day and artificial).

Site. This *should* be open, airy, high-up, dry, near the centre of the area from which the children come, and *not* close to factories, railways, busy streets or slums. Lastly the soil should be clean, and the size sufficient. Clearly a good many of the above points are interdependent, e.g. the more open and the higher the site the more airy is it. The reasons which make the above conditions desirable are fairly obvious: thus (1) site should be *open* because if too close to other buildings or surrounded with trees, air and light are cut off and the playground is likely to be too small. (2) It should be *near the centre of the area* served so that no child may have too far to walk to school. (3) It should not be close to railways, factories, or busy streets because of the noise, which produces nerve-strain on teacher and children, subconscious though the realisation of the noise may be. There is also the danger of traffic causing accidents. (4) Slums mean sights, sounds, and language that one wants to keep from the child's knowledge. (5) A dry site is desirable because damp buildings are bad for such diseases as rheumatism, tubercle, etc.

Dryness of soil depends on several factors, of which the chief are: (1) porosity of the underlying rock; (2) depth of the first impermeable stratum of rock; (3) slope of ground, and position on slope. With regard to (1), the porosity of rock depends on its geological nature. The greater part of the surface of England consists of "aqueous" rock, i.e. rock which has originally been laid down as sediment in water, and so occurs in layers or "strata," and there are three main types, viz. (*a*) limestone and chalk (chiefly calcium carbonate, $CaCO_3$); (*b*) sand and sandstone (chiefly silica, SiO_2); (*c*) clay, shale, slate (chiefly silicates). Of these (*a*) is very porous and so is barren as regards vegetation, but very healthy for human habitation. Its porosity is largely due to the existence of a regular series of cracks, called *joints*, running across the strata, as indicated in the usual diagrammatic method of representing these rocks. (*b*) Is moderately porous if hard, the joints not being so well marked as in (*a*). If loose, it is very porous. (*c*) Is waterproof, and hence rain lies on its

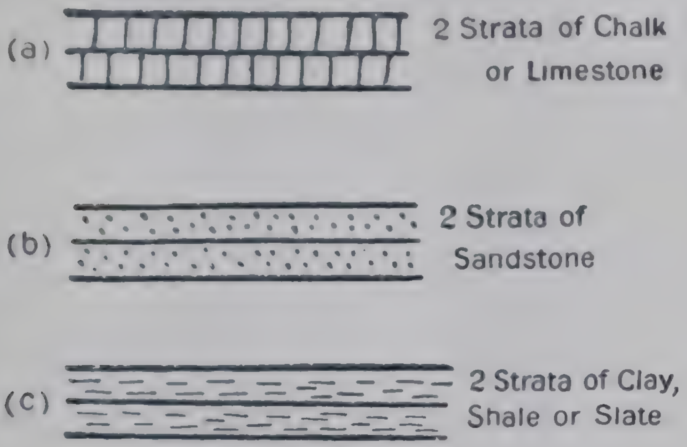
(a)
2 Strata of Chalk or Limestone
(b)
2 Strata of Sandstone
(c)
2 Strata of Clay, Shale or Slate

Fig. 70

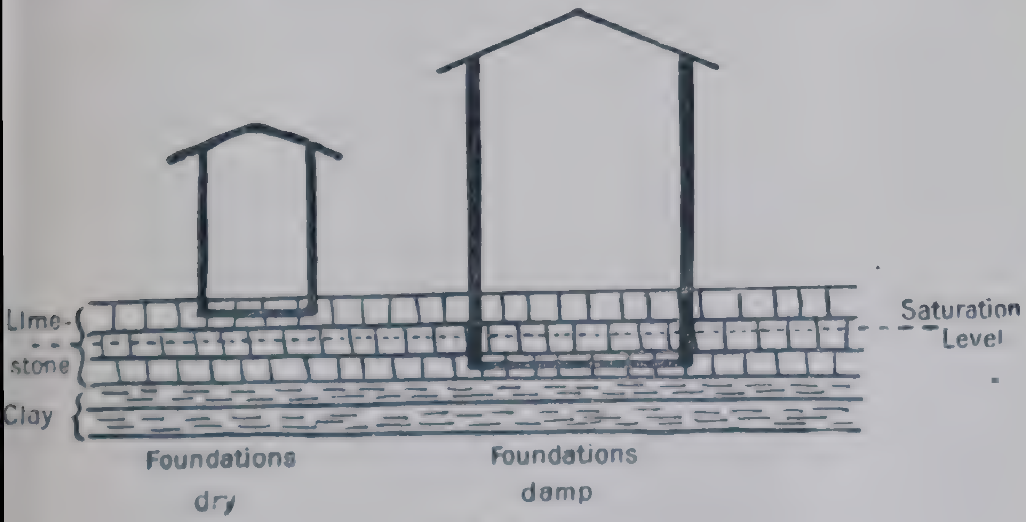
Lime- - - stone
Clay
Saturation Level
Foundations dry
Foundations damp

Fig. 71

surface, giving luxuriant vegetation, but very undesirable building sites.

With regard to (2), the rock composing the crust varies in character, and one is quite likely, for instance, to find limestone on top of clay. If so, rain will run through the limestone till it reaches the clay, but will then be checked and will therefore water-log the limestone over it to a certain height (saturation level) which will vary with the rainfall and season. Clearly a school built on the limestone should have its foundations *above* the saturation level, and the further the clay is from the surface the better.

With regard to (3), if the ground slope, water will run off it and hence it will be drier than if flat.

A damp site sometimes is unavoidable, and then the only thing to do is to drain it by digging trenches deeper than the foundations, to collect water. In any case, the foundation should be *concreted* and there should be an *air-space* under the ground-floor, ventilating through air-bricks into the outer air ; also there should be a damp-proof course in the walls, below the floor-level, to stop the rise of water through the bricks. Some stone and brick has very considerable capacity for absorbing water.

As to *size of site*, the Board demands forty-two square feet per child if there is only one story, or thirty square feet if more than one story.

Playgrounds have not probably been yet used to their fullest capacity, and some of the suggestions that have been made and some of the experiments tried are worthy of note. Of course, a playground should be *drained*, so that there are no standing pools of water after rain, or sloughs of mud which is brought into school on the children's boots. A part of it should be either asphalted or gravelled, and most people prefer asphalt as being cleaner, less dusty and less likely to cause dirty wounds if children fall, though it is slippery in frosty weather. It should be on the sunny side of the building, and high walls are bad because they cut out sun. On the other hand, some shelter is necessary for wet weather and for very hot weather, and at present this is often inadequate, being provided by a covered shed against one wall. If possible there should be a few shady trees planted in the playground, well away from the school. These will be very useful if classes are taken in the open, as they should be. Then there should be a part devoted to flowers. So many playgrounds are a dreary barren waste, almost intolerable on a hot day.

Some of the innovations suggested in the use of the playground are: (1) That school playgrounds should be open out of school hours as well as in, so that children may use the streets less. It is said that the provision of playgrounds in New York has reduced juvenile crime by sixty per cent. (2) The Board of Education recommends simple appliances in playgrounds, and these might include swings, see-saws, sand-box and buckets, building blocks, etc. The sand-pile is common in America and Germany and is coming into use in England. Its appeal is undoubted; see how children congregate in the sand stored in street-receptacles (under lamp-posts in some places), etc. The sand needs pretty frequent washing. (3) The Board of Education is strongly in favour of using the ground for open-air classes, and in addition some enthusiasts, like Miss M. Macmillan and Miss Sewell, the Organiser and Secretary of the City Children's Fund, say it should be used *at night*, for sleeping. The latter has experimented with a piece of walled-in ground in Canning Town, which was secured for a year, and which was used day and night, all the year round, for gardening, sand-play, games and *sleeping*. The children had trestles and hammocks slung on them, and the boys made the trestles and the girls the hammocks, blankets and sleeping-bags. The children put up the beds and made them, and various voluntary helpers managed things; these included a clergyman, a doctor, a club-organiser, a working man and woman, several teachers, a nurse and a trained drill-mistress. *Shower baths* were fixed up. The money needed was obtained voluntarily—and easily.

Results. In addition to better health, the helpers had educational chances which Miss Sewell considered very valuable; e.g. the elder children brought in most fearful trash, such as comic papers, to read in bed, etc., and Miss Sewell substituted Stead's 1d. books, though she says that much more might have been done. She makes interesting comments on the *difference in attitude of old and younger children.* The younger ones were fresh, keen, appreciative; the older girls were far more petty, they seemed only to care for trifles such as who should sleep next who, and their conversation was always concerned with trivialities. However, Miss Sewell says that even this could be directed; e.g. on one occasion she stopped it by suggesting that a nightgown should go on after the day clothes had come off, not on top of all the day clothes. The latter was the prevalent notion of the best way to use this garment. The result was a fierce argument which was a distinct improvement on the previous gossiping.

Types of Building. Single-story buildings are preferable to double or treble stories, because there is less strain on delicate children in going up and down stairs and less danger of fire. Practically the discussion of type resolves itself into a choice between the Central Hall and the Pavilion or Staffordshire type. Now, till recently the central-hall school was fashionable, and our towns are full of them, solidly and expensively built. It was said that they made supervision by the head teacher so easy, and beyond that I have never been able to discover precisely what their advantages are. Their disadvantages are numerous: (1) They cannot be efficiently ventilated by natural means. Hence many of them are ventilated by artificial systems, which are all bad, as we have seen. (2) They are noisy, noise permeating from hall to class-room and vice versa. The best and newest type is the Pavilion School, because one can get perfect natural ventilation in it and no noise-transference, and it is cheaper. (See Chapter V.)

Warming. The aim of all methods of warming living or class-rooms should be to get a method whereby the occupants and furniture and walls may be warmed, without heating the air, since too high temperature is one of the main factors producing the ill-effects of living in unventilated rooms. This is only possible in a system which depends on *radiation* of heat and not on *convection*, and most of our existing systems depend on the latter process. (For explanation of radiation and convection see any textbook on Heat.)

Convection heats the air, and then the air heats the object, and further the floor always tends to be cold and the top of the room hot, and so cold feet and hot heads result. Cold feet bring on congestion of the mucous membrane of the nose, and so produce a tendency to catch colds, to headache, etc. The hot-water system of heating works on this convection principle and therefore the so-called " Radiators " should be named " Convectors."

Methods of obtaining Radiant Heat. (1) The coal fire heats largely by radiation, but it has disadvantages, viz. dust, extravagance (nine-tenths of the heat goes up the chimney), also it sends a great deal of pure air up the chimney ; it is unsuitable for school because of the need of stoking, variability, etc. Hence we must try to replace it with something better. The modern gas fire is better, giving fifty per cent radiant heat, and no dust. It must have a proper flue and must not be turned on unnecessarily full, so that the room is made too hot. With these precautions there is no need for dishes of water, for gas dries the air no more than coal. The older types were bad because they had too much iron-work which got hot and " *convected* " ; also the gas often did not heat the fuel rightly and therefore carbon monoxide was formed instead of carbon dioxide. (3) Electricity may come more into use for heating.

Hot-Water Heating. This is the type commonly found in school, and there are two systems, known respectively as the high-pressure and low-pressure systems. In the high-pressure system, pipes of from one inch to one and a half inches diameter hold water heated to about 150° C. under pressure. Parts of these pipes are heated in a fire in the basement. The *disadvantage* is that parts cannot be disconnected, and so heat cannot be turned off from one room, say. The *advantage* is that the heat is greater and obtained faster than in the other system. In the low-pressure system larger pipes (two to four inches diameter) contain water never above the boiling point. This water is heated in a boiler in the basement. The *advantage* is that any radiator can be separated from the main system by a screw valve. The *disadvantage* is that in a big building some rooms may be very cold.

Floor-heating. Probably this would be the best method of applying hot-water heating—just as the old Romans did. It is in use at North Wingfield School, Derbyshire. Steam pipes run under the floor.

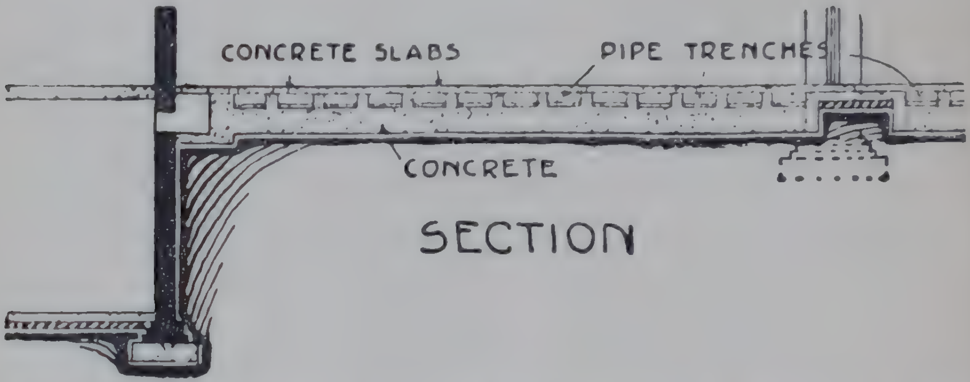

Fig. 72. Section of floor showing arrangements for warming in floor of experimental classrooms in North Wingfield Council School

(From *Crowley's Hygiene of School Life.* C. W. Hutt. Methuen)

Closed Stoves are not nearly so common here as in Canada, America and on the Continent. Unless of very good make and very carefully flued there is always a risk that the products of combustion may leak into the room, and these are likely to contain carbon monoxide, which is very poisonous, producing headache and nausea if present in very small amounts, and death if in rather greater quantity. The reason why there is more risk of this gas being present than with an open fire is that the air-supply to a stove is less than to a fire, and often there is not enough oxygen to oxidise the carbon in the fuel completely to carbon monoxide and so it only half-oxidises. There are " ventilating stoves " on the market, e.g. (1) George's Calorigen and (2) Bond's Euthermic; which act like the Galton fire-place, because they contain an air space, opening into the room and also into the outer air, and so they pass warmed fresh air into the room, but in no case are stoves satisfactory.

Lighting. A child needs better light than an adult because of the plasticity of the eye and the fact that type bothers it and has to be attended to. *The window area* should not be less than one-sixth or more than one-quarter of the floor area. Unduly increasing window area increases the difficulty of ventilating and warming, because windows chill a room in winter and warm it in summer. (In winter the window cools the hot air, which therefore falls and may chill people just under the window.) Windows should begin 3′8″ from the floor and reach to within 6″ of the ceiling. If the sill be higher than 3′8″ there is insufficient light on the desks under the window; and the nearer the top of the window to the ceiling, the more efficient outlet for hot air does it form, and the more light does it give. If surrounding buildings cut out much of the light it may be necessary to use *prism glass*, which bends rays entering nearly vertically so that they reach further into the room. The windows giving the main light should be *on the left* of the children so that they do not fling shadows of the right hand on the work. The next best position for windows is on the right. If behind the children, the shadow of the whole body is flung on the work and the glare is very bad for the teacher. If in front of the children, the

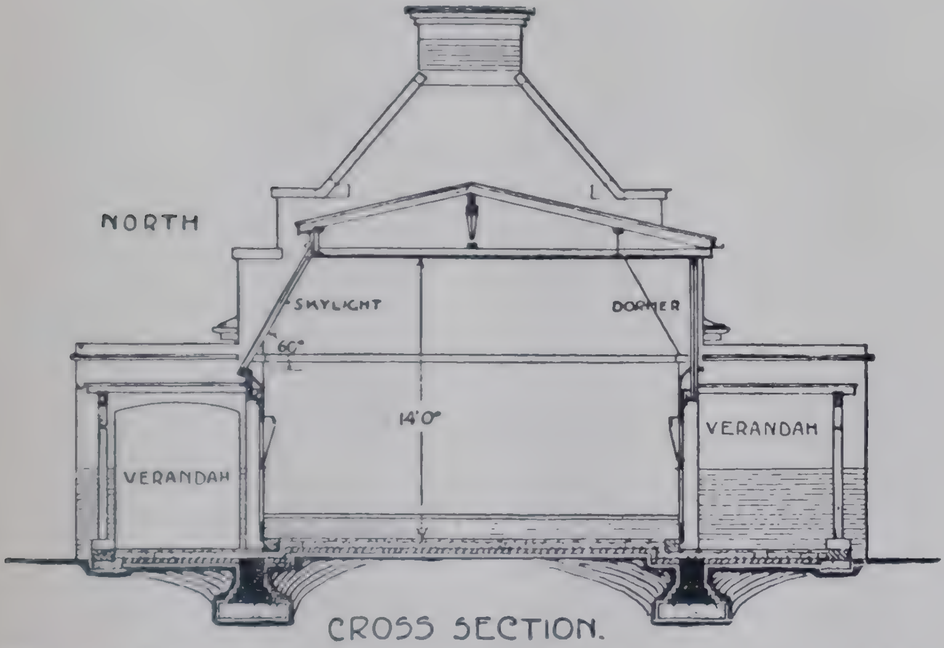

Fig. 73. Experimental classrooms at North Wingfield Council School, Derbyshire County Council. G. H. Widdows, F.R.I.B.A., Architect

(From *Crowley's Hygiene of School Life.* C. W. Hutt. Methuen) glare is very bad for them. The *width of room* should not be greater than twenty-two feet, because one cannot get adequate light further from the windows than this distance. Till recently *skylights* have only been allowed in halls, corridors, gymnasiums and laboratories, but at North Wingfield School, Derbyshire, two rooms are lighted by a skylight, five feet deep, running along the whole of the north side, and this is said to give a better and more even light than any other arrangement. The ventilation in this school is effected by glass doors on opposite sides of the room, so constructed that the top half of each can be opened, or the whole if need be.

Artificial lighting even when good tires the eyes more than good daylight, and therefore as far as possible close work should be stopped when daylight fails—anyhow for infants and the first three standards—and *all* needlework should stop. (1) Electric light is best because there are no products of combustion to contaminate the air, no using up of air and very little heating. The objection is the cost, which is still higher than gas, as a rule. It should be shaded to absorb ultra-violet rays which are bad for the eyes, specially of children. (2) *Gas.* Here the incandescent mantle is almost always used rather than the old-fashioned, flat, naked flame. The mantle only uses half as much gas and correspondingly only half as much air. The old naked flame vitiated air to the same extent as five women or seven children; the incandescent only to the extent of three women or five children. Opinions differ as to whether the inverted or the upright mantle is the better. The former flings no shadow under it from the gas-bracket, but one can get very good results from an erect burner *with a proper shade* (i.e. one whose sides are at 90°, and come down to the level of the "gallery"). On the other hand, the inverted burner does not burn the gas so competely as the upright, and one is therefore more likely to get undesirable gaseous products of combustion passed into the room. (3) Oil is only used in the country.

Arrangement of lights. The main desk-lighting should come from the left and somewhat in front of the child. Therefore the first lamp should be hung over the centre of the first dual desk on the left, and succeeding lamps at six-feet or nine-feet intervals, the shorter distance being for the younger children. The height should be six and a half feet from the floor.

Indirect lighting is the best method of artificial lighting, because it does away with glare. In this method, the lamps are quite hidden by reflectors placed under them, or by cornices, so that the light is first flung on the ceiling and is thence reflected downwards into the room, so giving a soft diffused light. One result of this is that shadows are faint, and therefore detail is more difficult to see, and so a stronger light is needed than is the case with direct lighting. Hence indirect lighting costs more than does direct.

Glare. This is so harmful to the eye that it is worth while to mention it, especially as usually very little attention is paid to it. No bright source of artificial light should be visible in school, and hence electric lights and incandescent gas mantles need opalescent shades or holophane globes, i.e. globes of ridged glass which bend the rays of light downwards without causing glare. Again, direct sunshine should never fall on a surface at which a child has to look. Neither should a child sit facing a window. Finally, bright, shiny, reflecting surfaces should be avoided ; hence the paint, etc., on walls and blackboards should be dull rather than polished, as should be the paper in the books used.

Test for lighting of room. See if a child with normal eyes can read small pica type at twelve inches from the eyes in every part of the room, *or* use the ordinary vision-testing card.

Sunlight, Smoke and Health. See Appendix VI, p. 329.

CHAPTER XXIV

THE SCHOOL BUILDING (*continued*)

Furniture and equipment: desks, infants' rooms, cloakrooms and lavatories, sanitary conveniences (common types), earth closets and their management, supervision of offices, need of training children in proper use of sanitary appliances, drainage—School cleaning—Disinfecting.

Furniture and Equipment. The most important item is the *desk*, which should fit the child reasonably, and it is stated by some authorities on School Hygiene that *adjustable*

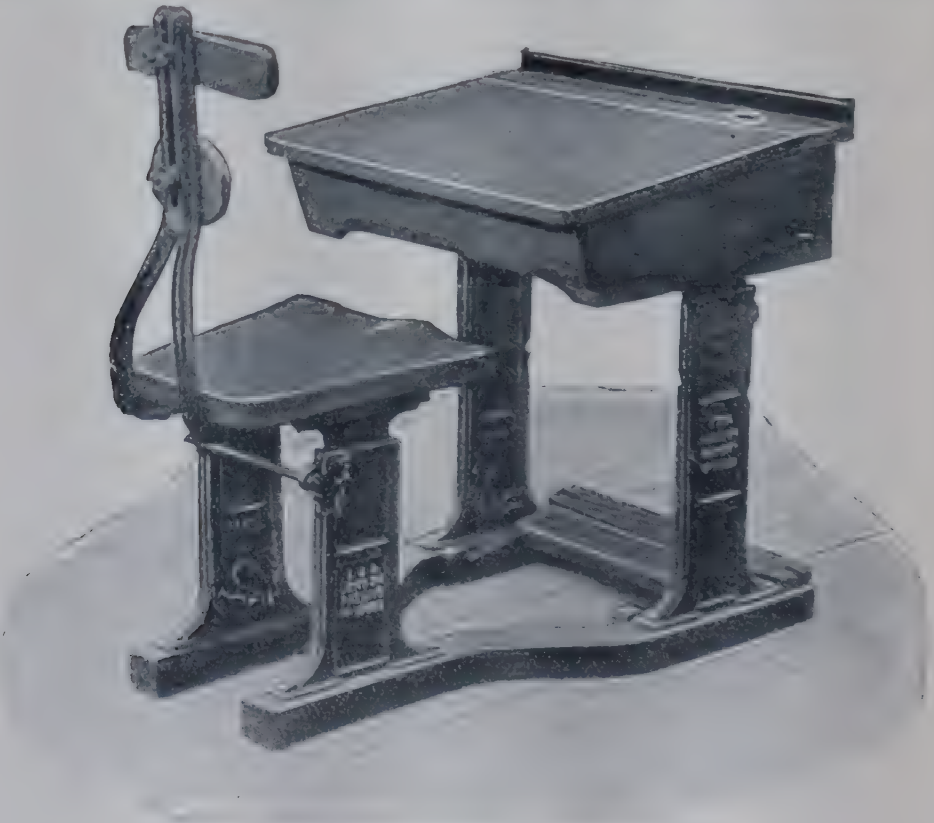

Fig. 74. The Farringdon Adjustable Desk

(From the Educational Supply Co.)

single desks are therefore necessary. Now it is doubtful if quite such precise fitting as is here implied is necessary, if we do not keep children sitting for too long periods, i.e. if we vary the time-table hygienically. However, if one is to have single desks, more money and more floor-space will be needed. A good type is the "*Adjustable Farringdon*," made from Miss A. Ravenhill's directions by the Educational Supply Association. It has a seat which can be raised or lowered in three-quarter-inch steps, and the desk can be adjusted in one-inch steps. The locker will slide backwards and forwards into *plus, minus or zero positions.*

In the plus position the edges of desk and seat are separated thus :

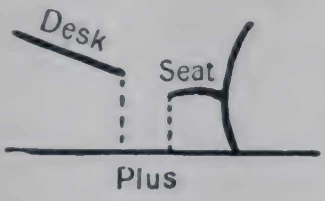

Fig. 75

In the zero position they are in the same vertical line thus :

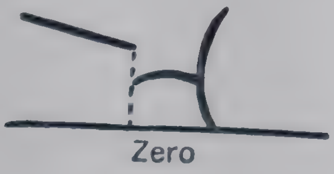

Fig. 76

In the minus position they overlap thus :

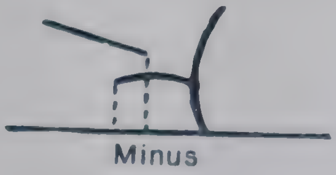

Fig 77

The minus is best for writing ; the plus for standing in the desk. The *slope of the lid* can be varied so as to be right for reading, writing, etc. Its lateral width is twenty-three inches, which is three inches less than it should be. The back rests are adjustable. There is a foot-rest, which is a pity, as it is better to have none. The seat is *sloped slightly backward* and is *saddled* to fit the thighs and its front edge is *bevelled,* so as not to press on the blood-vessels of the thigh. *Adjustment* should be done twice yearly, the seat being set at such a point that the thighs are at right angles to the body when the feet are flat on the floor. The *desk* should be at such a height that when the forearm is bent at right angles to the arm, the latter being close to the side, the forearm can just sweep the top of the desk. *Advantages.* In addition to the possibility of exact fitting of the desk to the child, single desks make overcrowding impossible, minimise the chance of exchange of germs, and increase the ease of supervision.

Dual desks are not so good as single, but better than "long desks." They usually allow a width of twenty inches per child, which is not enough for elder children. They should run up to twenty-four inches or twenty-six inches per child.

Of long desks, the " Sheffield " is the best type, because it has separate pedestal seats, with backs ; thus wholesale overcrowding is prevented, but these desks usually allow eighteen inches in lateral width per child, and this is inadequate.

Slope of Lid. Some people say that the *flat top* is best, and flat desks are being used in some schools. Obviously they are best for all manual and experimental work.

Infants' Furniture. The infants' room should contain :

1. An open fire, in addition to the ordinary heating apparatus.
2. Straw mats, or thick pieces of cork carpet for the floor
3. Tables and chairs.
4. Hammocks for sleeping.
5. Cupboards, not more than three feet high.
6. Piano.
7. Sand trough, spades, buckets.
8. Toys, i.e. swing, rocking horse, doll's house.
9. A few suitable pictures.

Cloakrooms and Lavatories. These need *particularly* good lighting, heating and ventilation and are often very unsatisfactory in these respects.

The Board of Education requires three square feet per child. There should be hot-water pipes in or between the clothes rails so as to dry damp clothes quickly. Metal fittings are best, and there should be a wire meshing separating the clothes on one side of the stand from those on the other. Pegs should be eighteen inches apart, numbered, and in a *single* row, and each child should keep to its own peg. . Umbrella racks should be provided—draining outside if possible

A concrete floor and glazed brick walls are best.

Basins. There should be enough of these, with clean towels *daily*, and soap in plenty. The *best towel* is a paper one—one per child. The *best basin* is a "continuous-flow," or a long trough into which the taps run, whilst the child washes under the running water which then escapes quickly. Otherwise, careful supervision is needed to see that the children do not use the same water and that basins are not used as flower-vases, etc.

Offices. The w.c. is far preferable hygienically to the earth closet. The number depends on the number of children and the regulations are laid down by the Board of Education. Seats are usually too high; they should be ten inches high for infants and twelve inches in other departments, because the weak spots in the wall of the abdomen are protected if

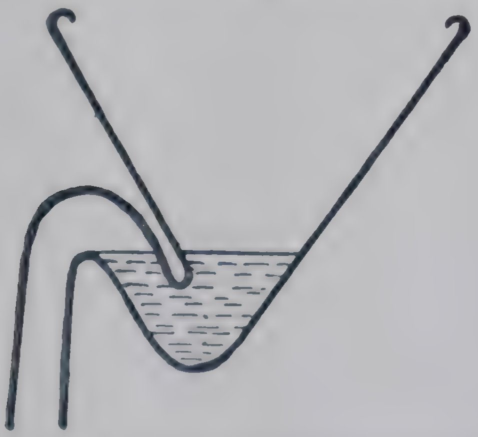

Fig. 78. Section through wash-down closet

the thighs come up against them. Single closets of the wash-down type, with as little woodwork as possible, are best, because simplest. The old type of closet with a wooden box-frame and a pull-up handle was bad because full of corners and holes impossible to keep clean.

Trough closets are found in some schools. They consist of a series of closets with a common flush acting automatically and a common trough. The flush often does not act frequently enough, sometimes only once or twice a week; hence very objectionable odours arise. It should act every two hours at least during school hours, and even then it is very difficult to keep the sides of the trough clean, neither does it give the child such good training in cleanly habits as when it has to flush the closet itself, as it has to with the single wash-down closet, and *at home*—and we must remember that we want school to be a constant object-lesson in how to behave at home.

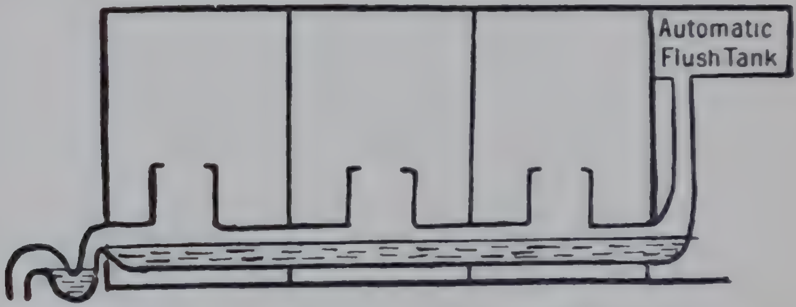

Fig. 79. Section through trough closet

Earth Closets. These are only permissible in the country or elsewhere where the water-carriage system is not available. In principle they depend on the fact that excreta with which dry earth containing certain bacteria is mixed becomes harmless and inoffensive in a short time, owing to the chemical changes produced by the bacteria which convert the nitrogenous compounds into simpler ones, viz. nitrates and nitrites. The best soils to use are dry, loose loam or garden soil, or clay. Sand, gravel and chalk are bad because there are practically no bacteria in them. One and a half pounds should be placed in the pail after each use of the closet, and to ensure this automatic earth closets are available in which the earth is stored in a receptacle above and behind the seat, and on pulling a handle the right amount is shot into the pan. One has to take care (1) that children do not play with the hopper, and (2) that the pail is emptied daily, at a sufficient distance from the school. The contents can be used as manure or can be again used in the closet after sufficient exposure to air.

Supervision of Offices. This at present is very often (not always) inadequate. It is needed for various reasons, e.g. :

1. Caretakers often neglect the cleaning of the offices if not very carefully kept up to the mark.

2. Several children will be found in one closet—hence comes lack of decency.

3. Children use closets so carelessly and dirtily if not trained, e.g. not flushing, etc. It is remarkable how badly many of the so-called working-classes treat the sanitary conveniences provided in their own homes, when these are of the modern type in which baths and w.c.'s exist.

4. Infants specially need training in good habits.

How is this supervision to be done?

At present only the teacher can do it.

1. The Head should go round the offices daily, to see if the caretaker is doing his or her work, and if things in general are right.

2. There should be an assistant taking charge of the offices at " break " and just before and after each session.

3. It has been suggested by a Committee appointed by the Training College Association to report on the sanitary conditions of girls' and infants' schools in London, that a woman caretaker be appointed as general supervisor of cloakrooms and lavatories in each school of any size, with a room of her own in the playground, near the offices. They point out that this need not be expensive ; a corrugated iron room with fire-place, windows, and washing apparatus is all that is wanted. This is already done in France. It would remove the duty of supervision from the teacher, on whom it falls hardly.

Duties of Attendant. (1) She should start work at 8.30 a.m. and remain till school closes. (2) She would be responsible for the care and cleanliness of the offices, for flushing and ventilation of lavatories, for distribution of clean towels *daily*, and the washing of them, for the behaviour of children in the offices, for the training of younger children in clean and decent habits and for the care of any child taken ill in school.

The Committee bring the following accusations against the schools :

(*a*) Want of more w.c.'s and basins.

(*b*) Want of more light, air, towels and soap. (Soap is often kept in the cupboard by the teacher, and one filthy towel is all that is provided.)

(*c*) The flushing of w.c.'s is often defective.

(*d*) It is very difficult to spare the teacher to look after a child who is taken ill suddenly in school, with the result that often it is taken to the lavatory or office by a child no older than itself.

Sewer Gas. Certain of the components of sewer-gas have the power of relaxing the throat and digestive tract, so increasing the liability to infectious diseases, such as diphtheria and typhoid fever, though sewer-gas alone cannot produce these diseases. However, it is very desirable to exclude it from a building, and this is done by (*a*) traps on all waste pipes ; (*b*) ventilation of drains.

(*a*) All waste pipes have a *syphon trap* at their upper end, i.e. an S-shaped bend which holds water and so stops gas

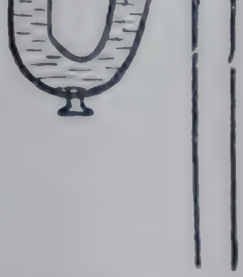

Fig. 80. Syphon trap

rising through it into the house. This is found under baths, sinks, hand-basins and w.c.'s. All waste pipes must *end* over a gulley trap out of doors, with the exception of the soil pipe, i.e. that from the w.c. which runs straight into the drain. The gulley is a box, let into the ground, with a grid for lid and connecting with the drain. The box holds water which covers the drain entrance. The drain is the property of the school, and at the lower end is a third trap, called a disconnecting trap or "*inspection* trap" which is sunk in the ground and covered with an iron lid and is big enough for a man to get into. This connects drain and sewer, the latter being the property of the Sanitary Authority.

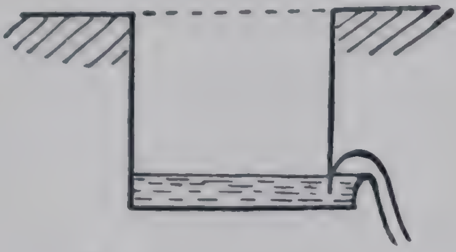

Fig. 81. Gulley trap

(*b*) Drain ventilation. The soil pipe is often used also as a ventilator, being run up above the roof and left open, though covered with a wire cage to stop birds building in it, etc. Its top should be well above any windows, or sewer-gas may enter the rooms.

School Cleaning.

Dust must be removed daily. Ordinary dry sweeping only partly removes it, the finer part simply being stirred up into the air, and this is the part containing germs. Therefore removal must be by *wet* methods. This is partially effected by sprinkling damp tea leaves or sawdust (the latter must be soaked overnight or the water is not absorbed), but the spray is best. Lumley's Spray is a good type, and the right method is to shut up the room for one hour after the children leave, so as to let the dust settle. Then spray, sweep and burn the dust if possible. If not, put it in a dustbin emptied *daily*. Then run over desks and seats with a damp duster, This *is* done daily in some schools. In addition, scrubbing of seats, desks, tops of cupboards and floors should be done *fortnightly*, with any plain soap. Carbolic soap is of very little use. The London County Council arranges for this every three weeks. Cloakrooms, offices and infants' rooms need it oftener, viz. weekly. Some Sanitary Authorities now demand strict cleaning registers in schools, signed by a responsible person. School cleansing and disinfection has been much neglected by some Sanitary Authorities.

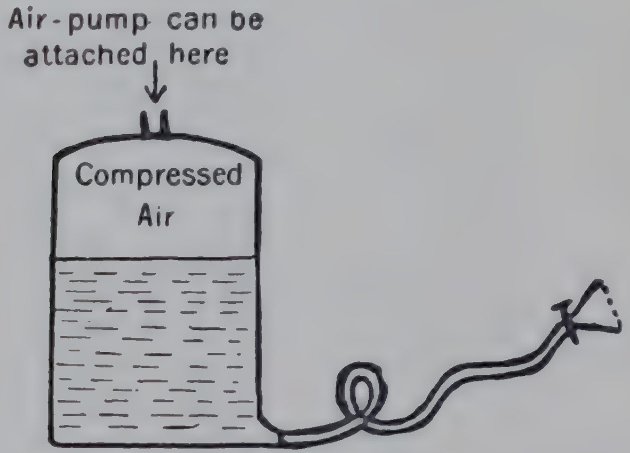

Fig. 82. Spray apparatus (diagrammatic)

Disinfecting is not necessary for ordinary school cleaning. Most Authorities consider that the chief source of infection is the body of the child. However, after an outbreak of a disease some disinfectant must be used, but the Sanitary Authority should do the work, for only they have the necessary apparatus. As to disinfectants, formalin, izal and cyllin are excellent and much more powerful than carbolic. Also they have not its unpleasant smell, and are non-poisonous. If carbolic be used, put two tablespoonfuls to a pint of water. To disinfect *books*, hang in a room or cupboard on a line, in formalin vapour. Special lamps can be bought, for volatilising formalin tabloids.

CHAPTER XXV

MEDICAL INSPECTION AND TREATMENT[1]

History of growth and development of medical inspection—Need for it—Duties of school doctors and nurses—Co-operation of teachers—Methods of treatment—School clinics—Future developments and possible extension—After-care of the school-child.

THE *Education Act of* 1907 introduced Medical Inspection, and may be said to have marked the abandonment of the *laissez-faire* policy in dealing with disease. The results of this policy in the past are seen in our hospitals, asylums, prisons, poor-law infirmaries, convalescent homes and the consequent heavy expenditure in rates and charities—this only patching the evil.

The new policy is to attack the cause of illness, and its motto is, "Prevention is better than cure." It also will cost much, but the money should produce a decrease in the evil attacked.

History. Interest in School Hygiene only began at the close of the nineteenth century, though there had already been a few foreign enthusiasts, e.g. *Ling*, the founder of Physical Education in Sweden. *Lorinser*, writing about 1836, was the first man to study School Hygiene thoroughly in Germany. In France, *Sequin*, 1842, published a book on the treatment of idiots, the first practical work on right methods of education for defectives. In the same year a governmental decree was issued in Paris dealing with the inspection of schools and school children, though the scheme was very immature and largely voluntary. In 1879, however, a definite system of school-inspection began in Paris. *Cohn* (Breslàu) observed defective vision in schools. He reported on the sight of 10,000 school children, with the result that the question of Medical Inspection was raised. *In Sweden*, there seem to have been medical officers in connection with some of the schools as far back as between 1830 and 1840. *Brussels* appointed school doctors in 1874, and the movement soon spread to other parts of Belgium. In 1875 *Bowditch* measured the height and weight of 25,000 American school children. England was, as usual, behind the times, for most European Governments took up the matter before ours. The first school doctor in *Germany* was appointed in 1883 at Frankfurt-am-Main, and it was in this country that a comparatively complete type of medical inspection was first inaugurated.

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[1] See *Medical Inspection of Schools*, by A. H. Hogarth, 1909, and Reports of the Chief Medical Officer of the Board of Education, and Crowley's *Hygiene of School-life*, by Hutt

Hungary appointed school doctors in 1887.
Moscow ,, ,, 1888.
Norway ,, ,, 1891.
Switzerland ,, ,, 1894.
U.S.A. ,, ,, 1894, in Boston.

And the movement has gradually spread.

Japan quickly took up the idea and now has a very complete system.

However, a good deal of individual and private work was done in England, e.g. *Warner* examined the mental state of a number of school children and so led, in 1888, to the appointment of a Committee of the British Medical Association for the study of child-life. Also the more progressive School Boards appointed medical advisers, e.g. London did so in 1891, and in 1893 Bradford appointed Dr. James Kerr, the pioneer of Medical Inspection in England. The first Government step was the appointment of Medical Officers for the Elementary Education (Blind and Deaf) Act, 1893, and the Elementary Education (Defective and Epileptic) Act, 1899; but most of the appointments were underpaid and held along with other offices. Still, it did bring doctors into touch with educational aims and methods. Further steps partly resulted from the South African War, which showed up the physical deterioration of the class from which recruits came; and in 1903, an Interdepartmental Committee suggested Medical Inspection for Schools. In 1907, the Education (Administrative Provisions) Act made it compulsory.

Arguments for Medical Inspection. 1. A large number of children attend the State schools suffering from preventable and remediable disease, e.g. defective teeth, verminous hair, defective vision, anæmia, deafness, general debility, etc. With regard to the state of children *on entrance*, the following facts are of interest. (*From Report of Chief Medical Officer of Board of Education*, 1914.) Medical Inspection has revealed a serious amount of defects in children entering school between three and six. In 1914, uncleanliness of body sometimes reached thirty-seven per cent, uncleanliness of head was still commoner, being fifteen to twenty per cent in many areas, and in some up to forty-four per cent. *Rickets* occurred in one to three per cent on the average, but up to eight per cent in some towns. *Eye disease such as conjunctivitis, blepharitis, etc.*, gave much the same numbers as rickets, running up to twelve per cent in some towns. *Discharging ears* occurred in one to three per cent in town *Diseases of nose and throat* vary widely and are *not* always worst in town (ten to thirty per cent). *Enlarged tonsils or adenoids* occur often in over twenty or thirty per cent in town. *Malnutrition* is found in five to thirty per cent, and is worst in town. *Defective teeth* are often found in over seventy or eighty per cent. Again, the Report of the Chief Medical Officer of the Board of Education for 1916 sums up the conditions of health of our elementary school children thus: "Of the children in attendance at school (six million), we know by medical inspection that many, though not specifically 'feeble-minded,' are so dull and backward mentally as to be unable to derive full benefit from schooling, that upwards of ten per cent of the whole are at a like disability on account of uncleanliness, and that ten per cent also are malnourished. Then we come to disease. Perhaps the largest contributor is dental disease, which handicaps children almost as seriously as it does adolescents and adults. Probably not less than half the children are in need of dental treatment, and a substantial number (not less than half a million) are urgently so. Again, upwards of half a million children are so defective in eyesight as to be unable to take reasonable advantage of their lessons. Many of them need spectacles, some ophthalmic treatment, others special 'myope classes,' and all of them careful supervision and attention. Next we must add diseases of the ear, throat and lymphatic glands, another quarter of a million in a relatively serious condition. Then there come skin diseases, disorders of the heart, infectious disease and tuberculosis."

This means that not less than a million children of school age were, in 1915, so physically or mentally defective as to be unable to derive reasonable benefit from the education which the State provides. These returns give cause for anxiety, especially as much is due to earlier conditions, such as measles, whooping cough, epidemic diarrhœa, respiratory disease, etc., which have already killed so many babies.

2. Parents are often ignorant and obstinate, and through Medical Inspection they may be educated; the children of the poor are handicapped through life not so much by squalor as by ignorance and obstinacy of parents.

3. Healthy citizens are the State's chief asset, and therefore the State needs definite knowledge about the health of its children. The first step to this is a physical census of children; the second step is preventive measures.

4. From the educational point of view, increased attendance follows and therefore greater efficiency, e.g. transference of defectives to special schools brings education within their reach. About ten per cent of children in crowded districts suffer from remediable diseases which seriously hinder their education.

5. Medical inspection of schools is a necessary supplement to the work of the Public Health Department in two ways: (*a*) *Sanitation.* Thousands of schools are totally unfit for their purpose, having unsuitable buildings, overcrowded class-rooms, bad ventilation, heating and lighting, unsatisfactory cloakrooms and offices, and little attempt at any good system of cleansing, and though the doctor is often

unable to get structural reforms, he *can* instruct the teacher how to make the best of the existing premises. It is, however, very desirable for the doctor to co-operate with the architect and sanitary engineer. (*b*) *Prevention of infectious disease.* At one time, daily inspection was suggested, and actually done in the United States of America, but it is impracticable because of expense and interference with school routine. Again the school is *not* such a centre for infection as is usually thought; it should rather be a convenient place for controlling the spread of infection. Certain chronic communicable diseases have not yet been touched by the Public Health Authorities: ringworm, vermin, skin-disease, ophthalmia, etc. These are mostly diseases of children, and their suppression is an important function of medical inspection. Hence the work of medical inspection should be carried out in close connection with the Sanitary Authority and under direct supervision of the Medical Officer of Health. In many cases the school doctor is also Medical Officer of Health.

6. *The claim of the individual child.* There is no doubt of the individual benefits to be derived from medical inspection followed by the necessary treatment. Even in secondary schools many children have astigmatism or short sight for years before the defect is recognised. They get red eyes, headache, etc., but nobody interferes, and they are called stupid or careless. Defective teeth are often not noted till toothache occurs. Anæmia is often unrecognised in girls, and overstrain follows examination work, violent exercise, etc. Headaches usually mean that there is a remediable cause needing discovery. Slight spinal curvature is rarely detected, but is important and only remediable in the early stages. The remedy for this is (1) medical inspection to diagnose and prescribe treatment. (2) Treatment.. We, as teachers, should specially remember that no teacher can do justice to the individual child without knowledge of its mental, moral and physical development, which cannot be obtained without the doctor's help.

Duties and Qualifications of the School Doctor. The code of 1908 assigns the following work to the school doctor: (1) Reporting on open-air schools or other such arrangements.

(2) Advising or approving closure for epidemics. (3) Authorising exclusion of children because of uncleanliness, infection or inability to profit by school work. (4) It also assumes that he will supervise and control medical inspection. Hence he *should* be responsible for the following duties : (*a*) To examine cursorily on admission to the infant school, as to cleanliness and obvious physical defects. To examine in detail about the time of transference to the upper school, and decide if special education is needed. To examine at certain later ages. (*b*) Re-inspection of those needing treatment. (*c*) To inspect all classes several times a year for general health and conditions of work, e.g. lighting, physical exercise. This also gives the teacher an opportunity of reporting "special" cases. (*d*) To inspect once or twice a year all eye cases. (The teacher should test vision once a year.) (*e*) To supervise the work of nurses, in regard to vermin, ringworm, etc. (*f*) To advise the Health Committee of each school. (*g*) To give lectures to teachers and others on Hygiene. (*h*) To deal with the question of Medical Certificates of absence given by other doctors. (*i*) To investigate (if necessary in conjunction with the Medical Officer of Health) epidemics and take measures to stop their spread.

With regard to the above the Board of Education stipulates that : (1) Inspection be in school hours on school premises. (2) The convenience of the teacher must be considered. (3) A record of inspection must be kept at the school and a copy transmitted with the child, if he changes school. (4) The minimum number of inspections is three : (*a*) At, or as soon as possible after entrance (three to six). (*b*) Between eight and nine. (*c*) Between twelve and thirteen and those over thirteen not examined after twelve. Inspection on leaving is advised.

Modification due to the War. In 1915 the Board of Education informed Authorities that it did not wish to put obstacles in the way of school doctors volunteering, and if curtailment of the school work was therefore necessary, the first charges on the staff should be (*a*) medical inspection of ailing children of all ages. (*b*) Maintenance of any arrangements for treatment undertaken by the Authority. Hence in some areas, *routine* medical inspection was temporarily suspended.

Duties of School Nurses. Nurses are now employed in most areas. The total number is 5,184 and they do various kinds of work. Thus, at present (1) they visit schools regularly in many places, to help teachers select ailing children, who are then examined by the doctor at school or clinic. (2) In some areas they visit regularly for cleanliness surveys. (3) Children needing treatment are followed up by the nurse visiting the home, where she emphasises the importance of the doctor's advice and shows parents how to treat minor ailments and uncleanliness. She may be very useful in connection with the examination of children before they return to school after an infectious disease, e.g. she may swab throats at home, where this is safer than having the children come to the clinic. Her duties may be combined with those of a health visitor and tuberculosis nurse. This is actually done in Warwickshire, Durham County, Willesden and Croydon. (4) Where a clinic exists, she may be employed for part or all of her time in it. (5) Each special school needs a nurse. (6) Sometimes she takes children to hospital when parents say they cannot spare time. (7) Sometimes she helps at school inspections by preparing children for the doctor, entering details in registers, etc.

Co-operation of Teachers in School Medical Work. It is difficult to overestimate the value of the help which the teachers can often give the school medical work. They can do a tremendous amount in seeing that *treatment* is secured. They know parents and children in a way that no one else does and by steady pressure can often get the parent to act on the doctor's advice, specially in the matter of cleanliness. Dr. Scatterly (Keighley) says that the weekly march-past before the teacher, as a means of controlling uncleanliness, has become a recognised institution in some schools, with most satisfactory results. Teachers can also be of the greatest help in selecting children as "specials" for examination, this of course involving a knowledge of common defects, their symptoms and importance, and also in preventing epidemics of infectious disease by quick observation and

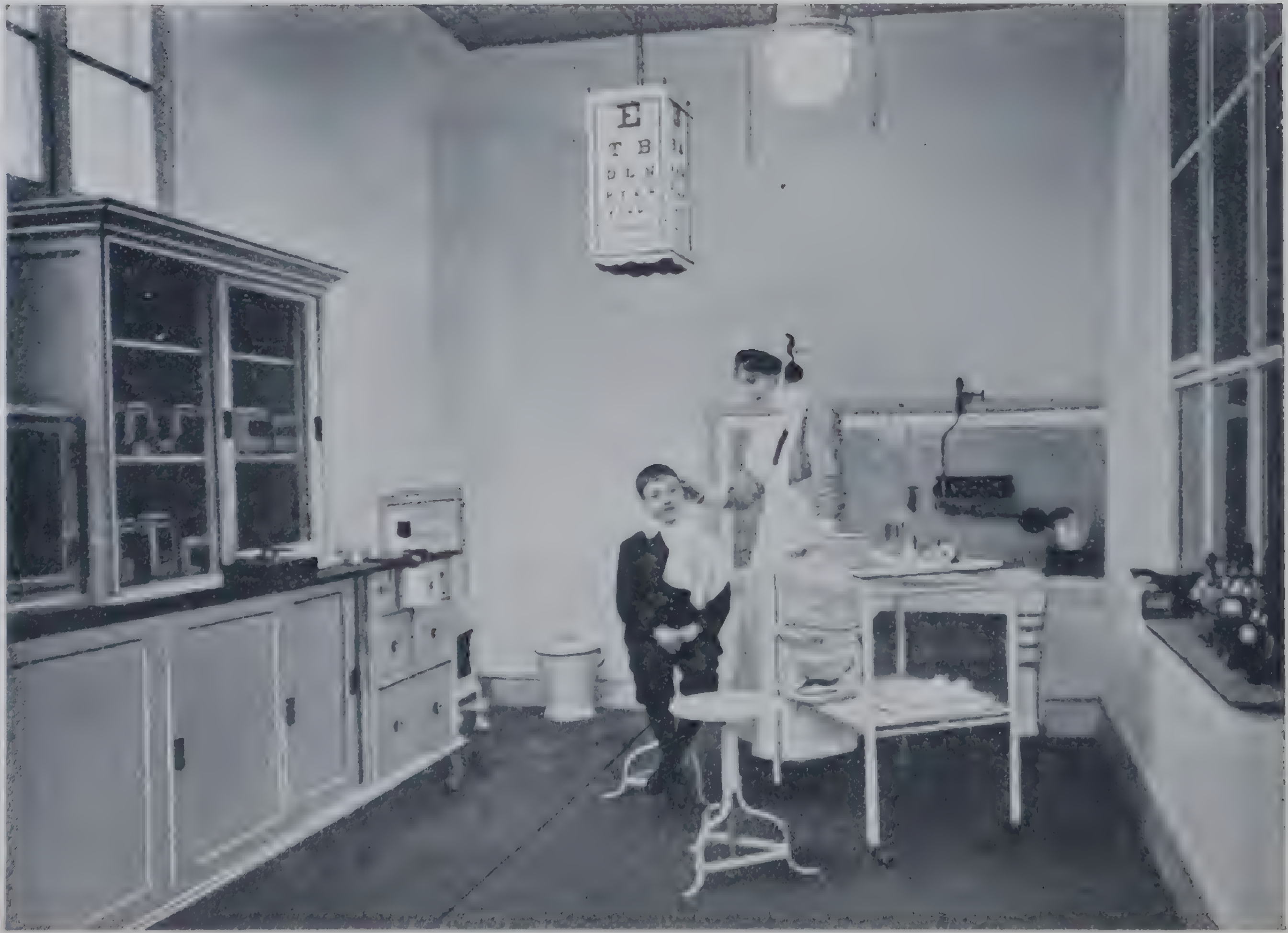

Fig. 83. Room in Abertillery School Clinic

exclusion. In many places they have relieved the medical staff of the work of taking heights, weights, etc.

Treatment of Defects. This is the logical completion of inspection, the money spent on inspection being largely wasted unless remedy of the evils detected follows. In 1908, the year after that in which medical inspection was instituted, 55 Education Authorities provided medical treatment, and now every Authority does so to some extent. Now, when medical inspection began, the existing means of treatment were twofold: (1) Private doctors. (2) Hospitals. Children were often debarred from (1) because of expense, and from (2) because hospitals were often overcrowded and so admission was difficult; also in the country, hospitals are often difficult to reach; again hospitals do not treat certain of the defects so often found in children, and so harmful in the long run, though not acute, e.g. decayed teeth, short sight, etc. Parents often say that they cannot spare time to take the child to the hospital; also out-patient treatment is often not detailed or prolonged enough for the cases revealed by medical inspection. Hence the demand for *school clinics* arose, i.e. buildings or rooms, conveniently placed for the whole town or district, at which children may be inspected or specially treated for defects which would otherwise probably be neglected, e.g. teeth, eyes, throats (adenoids and tonsils), discharging ears, anæmia, spinal curvature, ringworm, vermin, etc. Over seventeen hundred clinics existed in 1930, some for *dental* work only, some for general treatment, some for inspection only, e.g. re-examination of the child before returning to school after infectious disease, or for more detailed examination of certain children than is possible in routine school inspection, e.g. those who ought to go to a special school. Some are for X-ray treatment of ringworm only, and so on.

Co-operation with Hospitals is the next commonest form of arrangement for medical treatment, by means of contribution to hospital funds. Seventy-eight areas do this; thirty-nine for eye treatment, twenty-one for X-ray treatment of ringworm, sixty-one for tonsil and adenoid operations, five for minor ailments and two for dental ailments. Also many hospitals treat defects of school children apart from an arrangement with the Education Authority.

Between 1908 and 1928 the number of Educatio Authorities which have provided clinics has grown fro 7 to 315, and the number which contributes to hospitals fro 8 to 282, and the number which provides spectacles from 2 to 310.

About fourteen per cent, i.e. thirty-nine of the Loca Education Authorities do nothing whatever for the medica treatment of the children under their care, and it is estimate that still forty per cent of the children who need medical car receive none. As *The Times* puts it, "Ignorant parents combined with ignorant local authorities are doing as muc havoc as the guns." However, Mr. Fisher's Bill, which i now practically law, will do away with this, as it makes i *compulsory* for the Local Authority to provide treatment.

Equipment of the School Clinic.[1] This will depend on th kind of work done and on the number of children likely t need treatment. The chief needs are :

1. Waiting-rooms, more than one being necessary so tha children who come to be examined after an infectious diseas or after "contact" with one (e.g. diphtheria) may not b mixed up with other children.
2. A consulting-room for each doctor.
3. A treatment-room for eyes, ears, sores, etc.
4. A room, at least twenty feet long, for vision-testing.
5. A dentist's room.
6. An X-ray room for ringworm, and a small dark-room.

It is desirable also to have :

7. A room for cultivating and examining germs.
8. If tonsils and adenoids are operated on, an operatin room, with a recovery room with perhaps ten beds.
9. If deformities are treated by remedial exercise, a roo for this.
10. A bathroom and dressing-room for verminous childre
11. A nurse's room.
12. A clerk's room.

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[1] From Crowley's *Hygiene of School Life*, by Hutt.

It is best if the clinic be part of the building in which the Public Health Department, Tuberculosis Dispensary and Chief Infant Welfare Centre are housed, so as to get co-operation and continuity in dealing with the health of children.

Work of Voluntary Agencies. Children's Care Committees, Invalid Children's Aid Association, the National Society for the Prevention of Cruelty to Children, Children's Holiday Fund and the Guild of Help do most excellent work in connection with the medical treatment of children. A number of clinics are provided voluntarily.

Future Developments. The trend of opinion to-day is all in favour of extension of medical supervision backwards and forwards, so as to embrace healthy parentage, the care of infancy *before* school life, and continued physical education, supervision of employment and some practical guidance in the duties of healthy and responsible parenthood after school life, up to the end of the adolescent period. Already we have Schools for Mothers, Infant Welfare Centres, etc., on the one hand and Juvenile Employment Committee and Continuation Classes on the other. One subject which can well be dealt with at a school for mothers is the medical inspection of school children and the advantages which may be expected from it ; these are not, as a rule, understood by the mothers. Special subjects such as personal cleanliness, care of teeth, reason for preventive dental treatment, malnutrition, rheumatism, mouth-breathing and nasal obstruction, defective vision, and the value of spectacles are among the subjects which suggest themselves. Infectious diseases, and particularly the care of measles and whooping cough, which are usually nursed at home, may be discussed in some detail. These schools for mothers were originally established to teach mothers the right way to feed and look after babies, but the scope of the work has in many cases been stretched so as to bring the young child not yet of school age under medical supervision. Circular 852 of the Board of Education shows the lines on which a school for mothers should be run (see also Chapter XXVII).

After-care of the School Child, i.e. during Adolescence. There are only three Acts of Parliament dealing in any way with this, viz. the Factory Act, the Employment of Children Act, and the Education Act (1918).

The Factory Act prescribes certain sanitary conditions, precautions against accident, and medical inspection, but in practice it is said to be nearly worthless, because the factory doctors are employed by the owner and not by the State, and often do their work perfunctorily. The remedy would be to put the factory surgeon on the staff of the school doctor and so get *continuity* of knowledge applied to the child.

However, many boys and girls are employed *outside of* the Factory Acts. These are affected by the Employment of Children Act which enables a Local Authority to make bylaws stating the age under which children may not be employed, and regulating conditions of employment in certain occupations, e.g. street-trading, and stating the number of hours which children still attending school may work out of school. All this, however, applies only *up to fourteen.*

Hence the machinery for guarding the health of the adolescent is clearly pretty inadequate, and consequently much of the care given to health in school is wasted ; e.g. a child with weak lungs goes into a printing factory or a child with weak heart goes into heavy work. The machinery needed is growing up, largely on voluntary lines, in the form of Committees to deal with employment. These are called " Juvenile Advisory Committees " if set up under the Board of Trade, and " Choice of Employment Committees " if under the Education Authority ; but each does practically the same work.

In London, these Committees include representatives from the School Care Committees, teachers, the school doctors, local employers of labour, trade unions, etc., and their work is organised as follows :

Just before the child leaves school the question of his future work is placed before him and his parents, generally at a meeting at the school between parents and representatives of the Labour Exchange, School Care Committee and Evening Schools. Here a school-leaving form is filled up, giving details of the child's career, ability, and the kind of employment the head teacher thinks best for him. Also the report of the last school medical inspection is given. If the parent has plans for the child's future, nothing further is done, except that the form is sent to the Labour Exchange.

However, if the parents have no particular plans for the child the question is dealt with by a sub-committee which meets twice a week at the Exchange to discuss available situations. Parents and children are invited to these meetings. Thirdly, the Committee keeps in touch with the boys and girls for whom they have procured work, finds out how they are getting on, if they are suited to the work, and so on.

This movement is the beginning of health-supervision *after* school days. The age dealt with is from fourteen to seventeen, but the new Education Act (1918) raises the limit to eighteen. Further, when the Continuation School clauses of the new Act are put into force, there will be medical supervision of the adolescent up to the age of eighteen.

CHAPTER XXVI

FIRST AID IN MINOR INJURIES AND COMMON AILMENTS

EVERY teacher should know enough about the accidents and ailments that are likely to occur unexpectedly in school to enable him or her to do what is necessary before the doctor arrives, or in any case to prevent things becoming worse than they need be. In all but quite trivial matters the doctor should be sent for.

Unconsciousness. This may be due to various causes, e.g. fainting, epileptic fits, apoplexy, hysterical fits, concussion of the brain, or sunstroke, but all have one root, viz. injury to or disease of the cerebrum, and *in every case* the child should be laid flat on the floor, other children should be sent away, doors and windows should be opened so as to supply fresh air, and clothing at neck, chest and waist should be loosened. If the face be pale the head should be kept low, but if flushed, then the head should be raised. In the following notes this preliminary treatment is assumed in each case.

1. **Fainting.** This is the commonest kind of fit and is dealt with in Chapter IV.

2. **Epileptic Fits** are discussed in Chapter XIX. No stimulant must be given.

3. **Stroke or Apoplexy** is very unlikely to occur in school, but if a child fall without any sound and lie still, with its face flushed and noisy breathing, apoplexy may be suspected. The condition is due to a blood-vessel breaking in the brain, and it needs quiet, no stimulants, a hot bottle at the feet and a towel dipped in cold water on the head. A doctor must, of course, be sent for.

4. **Hysterical Fits** are discussed in Chapter XIX.

5. **Concussion or Stunning.** This is due to a shock to the

brain, caused by a blow or fall on the head, and therefore may quite possibly occur in school. The child falls down unconscious, its face is pale, its breathing very quiet or hardly perceptible and its body cold. Often it is sick when consciousness is returning.

Treatment. The doctor should be sent for and meanwhile a cold, wet towel should be put on the head. No stimulant must be given, and the child must be kept very quiet.

6. **Sunstroke** (heat-apoplexy or heat-stroke). This may result from exposing the bare head to a hot sun for some time. The child becomes suddenly sick, faint, and giddy and gasps for breath. It feels very thirsty, and the face is hot and flushed. Finally it may become unconscious.

Treatment. It should be placed in the coolest and shadiest place possible, stripped to the waist, and cold water should be poured on head and neck. When consciousness returns, a cold, wet towel should be kept on the head for several hours. Cold water should be given to drink, but no stimulant.

Bleeding

1. **Nose Bleeding.** Make the child sit up, with its head flung back and its arms above the head, as this decreases the blood-supply to the head. Apply a cold-water pad to the back of the neck and the bridge of the nose. Make the child breathe through the mouth. If this does not avail it can snuff up cold water with a little salt or vinegar in it.

2. **Bleeding from Wounds.** Here the aim of treatment is twofold: to stop loss of blood and to prevent blood-poisoning.

(*a*) *A clean scratch or slight wound.* Here the only danger is from blood-poisoning. Hence do not touch the wound nor wash it, but let the blood dry and so close the wound naturally. Then put on a pad of old clean linen or boracic lint and fix it in place with a bandage. If bleeding does not stop, put on the pad as before, but bandage it on *tightly*, and the pressure will stop the flow.

(*b*) *A slight but dirty wound.* Here the treatment is as before except that the wound should first be well swabbed with wool soaked in iodine solution (two per cent iodine in alcohol).

(*c*) *A deep wound.* Here the bleeding is more serious and may be either arterial (spurting) or venous (steady). Try to stop it by putting a hard pad of boracic lint on the wound and bandaging tightly, and if this fail, stop the flow, if arterial, by pressing on the artery near the wound, on the side nearer the heart.

To do this, the teacher should know the course of the main arteries and the position of the *pressure-points* on them. This can be learned from any good book on first aid, such as that of the St. John Ambulance Association (1s. net). Pressure on the artery can be kept up for a short time by the thumb, but if it be needed for a long time, a tourniquet can be applied, if the wound be in a limb.

A tourniquet consists of a hard pad and a bandage which can be twisted until very tight by a stick. It can be improvised by tying a knot in the middle of a handkerchief

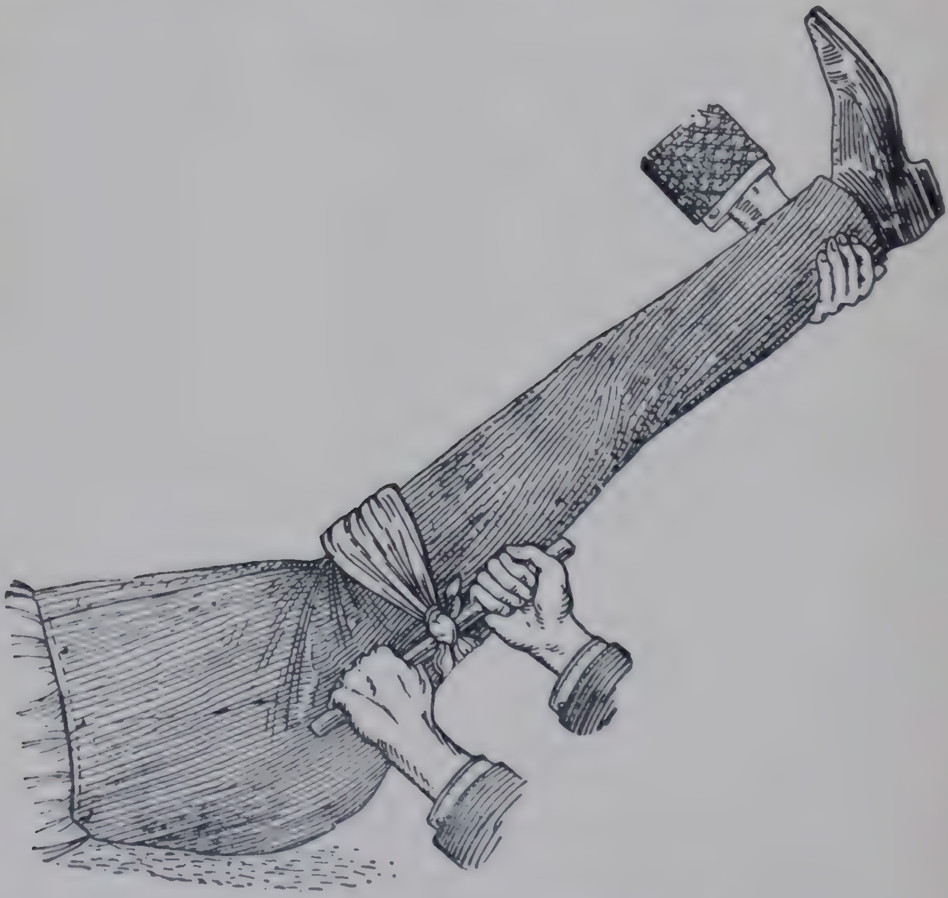


Fig. 84. Tourniquet on thigh

putting the knot on the artery, tying the ends in a reef knot on the opposite side of the limb, pushing a stick under this last knot and twisting it until the bandage is very tight. Or a hard pad, made from a stone wrapped up in a piece of lint can be used on the artery instead of the knot.

Venous bleeding is easier to stop. If pressure on the wound fail, tie a *tight* bandage round the limb on the side further from the heart.

Broken Bones. Directly a bone breaks it tends to shorten, because the broken ends cross, owing to the pull of the attached muscles. The periosteum and marrow both make bone-material and try to fill up the space between the broken ends with a sort of jelly which gradually dries, becoming putty-like and eventually ossifying, so mending the fracture. Hence the need of keeping the broken ends in correct position whilst the fracture is setting ; otherwise we get a distorted limb and the bone may have to be broken and re-set. Another reason for fixing the broken ends at once in correct position is that, if free, they stretch and tear the periosteum and surrounding tissues, so causing great pain. The jagged ends may even push through the skin, so converting a simple into a compound fracture and introducing the danger of blood-poisoning from the germs in the air. Hence a fracture should be treated on the spot where it occurs. Children are very liable to *greenstick* fracture, i.e. the bones are so plastic that they bend instead of breaking. Of the fractures likely to be met with in school, those of legs, arms and collar-bones are perhaps commonest.

Signs of fracture include pain, swelling, inability to move the broken limb, deformity (e.g. the limb lies in unnatural positions), shortening and greater mobility when another person tries to move the limb.

General rules for treatment :

1. Treat on the spot.
2. Do not remove clothing unless there is a wound.
3. Tie bandage tightly, with reef-knots on the splints.
4. Cover the patient to keep him warm and so lessen the effect of the shock of the accident.
5. If doubtful, treat as a fracture.

Broken Thigh-bone. Pull the foot gently till the injured leg is of the same length as the other, and then tie both feet together to a splint. A splint is a contrivance for keeping a limb stiff and can be improvised from broom-handles, rifles, umbrellas, walking-sticks, hockey-sticks, rulers, etc. In this case it must reach from arm-pit to heels and should be kept in place by six more bandages, as follows :

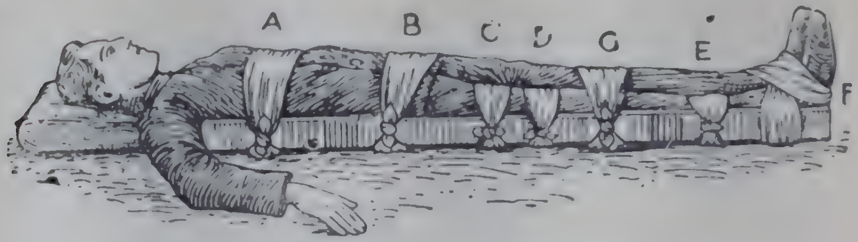


Fig. 85. Bandages for broken thigh-bone

(From *First Aid.* St. John Ambulance Association)

(A) Round the chest, just below the arm-pits.
(B) Round the hips.
(C) Above the fracture.
(D) Below the fracture.
(E) Round the lower leg.
(G) Round both knees.

Fracture of the lower Leg. Here, one or both bones may be broken ; in the former case there will be no shortening. Apply a splint as before, except that it need only reach from the heels to above the knees, and fix it with five bandages :

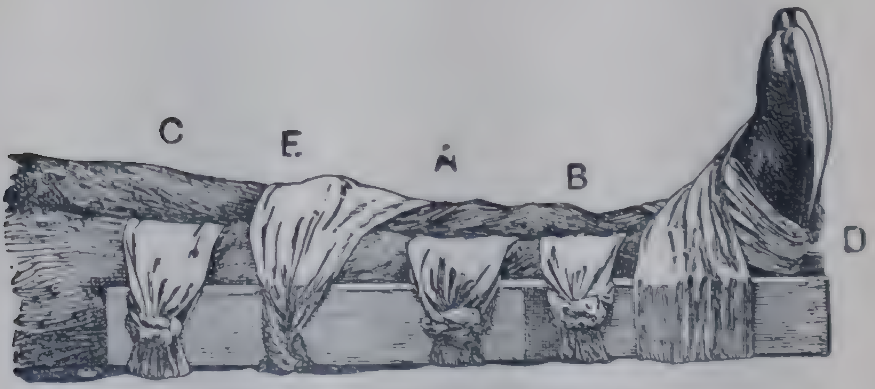


Fig. 86. Fracture of lower leg

(From *First Aid.* St. John Ambulance Association)

(D) Round both feet and splint.
(A) Above the fracture.
(B) Below the fracture.
(C) Above the knee.
(E) Round both knees.

Broken Arm. Put on two splints, one on the outside, from shoulder to elbow, and one on the inside, from the arm-pit to the bend of the elbow. Fasten with two bandages, one above and one below the fracture, and support in a sling.

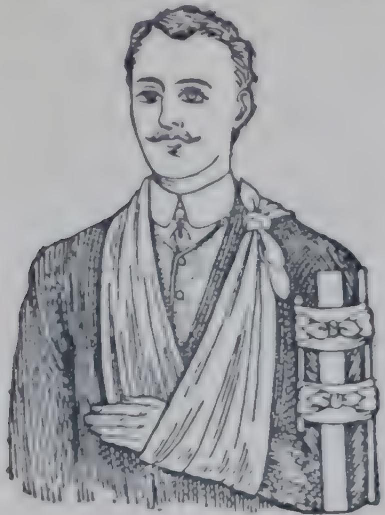


Fig. 87. Broken arm
(From *First Aid*. St. John Ambulance Association)

The diagram shows four splints, but two suffice.

Broken Forearm. Here, as in the leg, either one or both of the bones may be broken, and in the former case there is no shortening. Bend the forearm at right angles to the arm and apply two splints, one on the back and one on the front of the forearm, reaching from elbow to finger-tips. Fasten with three bandages: above and below the fracture and round the hand. Put the arm in a sling.

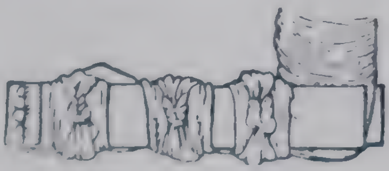


Fig. 88. Broken forearm
(From *First Aid*. St. John Ambulance Association)

Broken Collar-bone. This often happens in football, bicycle accidents, etc., and renders the arm more or less useless.

Take off the coat, put a hard pad (made by rolling up a stone or cork in a handkerchief) in the arm-pit, put the arm in a sling and tie the elbow tightly to the side, by a bandage round the body. This forces the shoulder out and so keeps the broken ends of the bone apart.

Dislocations. Here, the end of the bone is displaced at the joint, the commonest joints affected being those of the shoulder, elbow, thumb, finger or lower jaw. The symptoms are pain, swelling, unnatural position of the limb and fixity at the joint. The treatment consists in applying cold-water bandages, and when these cease to give relief, hot fomentations (a flannel or towel wrung out of hot water).

If out of doors, prevent jolting by putting the arm (if the dislocation lie in this limb) in a sling and fastening it to the body. In any case, send the child to or send for the doctor.

Sprains. These are due to the stretching or tearing of a ligament or tendon or muscle round a joint, owing to a wrench or twist. Turning the ankle over is the commonest example. The symptoms are pain, swelling and discoloration.

Treatment. If some distance from home, bandage the foot and ankle tightly, and then wet the bandage. This tightens it. If in the house, or on reaching it, remove the boot and treat as for dislocation. Prolonged rest is needed.

Bruises. These are due to oozing of blood from the capillaries into the surrounding tissues. Apply cold water to stop the bleeding, followed by hot water to help absorb the effused blood.

Burns and Scalds. Burns are due to dry and scalds to moist heat. The great danger is *shock* which means a state of collapse indicated by pallor, coldness, weak breathing and pulse, which may end in death.

Burns vary in severity from those in which the skin is simply rendered red and sore, through those in which it is blistered, up to the severe burn in which the skin and possibly the deeper tissues are destroyed. The last type, though most severe, is least painful, because the nerve-ends in the skin are destroyed.

Treatment :

1. Take off the clothing very gently, unless it be stuck to the wound, in which case cut round the stuck part, soak what is left adhering to the skin with oil and leave it for the doctor to deal with.

2. Never break blisters.

3. Cover the burn, at once, with lint or clean rag soaked in oil or smeared with vaseline, lanoline or cold cream. Any vegetable oil will do (e.g. linseed, olive oil, salad oil), but the best is carron oil, i.e. a mixture of equal parts of lime-water and linseed oil. If the burn be large the dressing should be put on in overlapping strips of the size of one's hand, instead of in one big piece, so that it can be removed a little at a time when fresh dressing is needed, so avoiding exposure of a large area of burnt flesh to the air.

4. Cotton-wool should then be put on and the whole bandaged.

5. Shock should be treated by supplying warmth and small frequent doses of brandy in hot water. Alcohol, being a narcotic, relieves pain. *Or*, hot coffee, or a teaspoonful of sal-volatile in a wineglass of water may be given.

Clothing on Fire. When a person's clothes catch on fire, he should not rush for help, as this causes a draught which fans the flames, but he should roll on the floor, if possible wrapping himself in a rug or table-cloth, because this may stamp out the fire and makes injury to the face less likely. (Flame quickly runs upward.) If another person be present, it is his duty to push the burning person down, fling over him a rug, coat or anything else available, and so crush out the fire.

Insect Stings. 1. Pull out the sting, if it can be seen, with fine forceps, or by pressing the end of a watch-key into the flesh round the sting. This often forces the sting out.

2. Mop the place with dilute ammonia, or spirits, or a strong solution of washing-soda.

Foreign Bodies. (*a*) *In the Eye.* Generally the foreign body is on the under-surface of the upper lid. Hence, take hold of the eyelashes and roll the lid inside-out over a match-stick, hairpin, small pencil, etc., and wipe the surface thus exposed with a handkerchief or camel-hair brush, towards the nose. Another method is to pull the upper lid over the lower and then let go, when the eyelashes of the lower lid will often wipe the obstruction off the upper lid. If this fail, put a drop of oil in the eye, bandage lightly, and take the child to the doctor.

(*b*) *In the ear.* Children often push beads, peas, etc., into each other's ears, and this is very dangerous because inflammation may be set up and spread to the brain. Fill the ear with oil, which may make the object float out. If it does not appear, take the child to a doctor. Never probe into the ear.

(*c*) *In the nose.* Children often push beads, peas, etc., up the nostrils. In this case, make the child sneeze, by giving pepper or snuff. Also, make him blow his nose hard, whilst closing the unaffected nostril.

(*d*) *In the throat.* This causes choking and must be treated quickly. Open the child's mouth, put the first finger down the throat as far as possible and try to hook the obstruction out. If this make the child sick, so much the better. If it fail, slap the child hard on the back, and if this also fail, hold him up by his heels, unless he be too big, whilst an assistant slaps his back. If the child become unconscious, apply artificial respiration.

Drowning. A child may get out of his depth in a swimming bath, etc., and be brought out unconscious and apparently dead, but one must never give up hope until prolonged attempts at restoration have been made.

Send for the doctor and also for hot blankets and bottles. Meanwhile loosen clothing at neck, chest and waist, clear the mouth of anything like seaweed, which may be obstructing the air-passage, turn the body face down and raise it at the waist for a few moments, to let water drain out of the stomach. Then turn it over on the back, put a rolled-up coat under the shoulders and apply *artificial respiration* thus :

1. Pull out the tongue and keep it out by tying a tape round it and the chin, or an assistant can hold it.

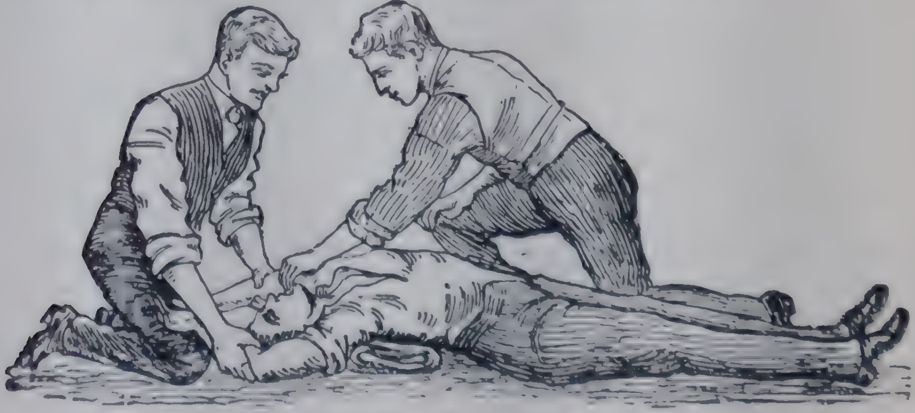


Fig. 89. Inspiration

(From *First Aid.* St. John Ambulance Association)

2. Kneel behind the patient, grasp the forearms just below the elbows, raise the arms above the head and then bring them down with strong pressure on the chest. The arms must be moved in the plane of the floor, not up in the air. Repeat this action seventeen times per minute, counting two slowly after each movement. The effect is that the ribs are alternately raised and lowered seventeen times per minute, as in natural breathing, and so air is forced in and out of the lungs. This should be kept up by relays of workers till respiration is restored or the doctor says the child is dead. Hot bottles should meanwhile be put at the feet.

3. Directly any signs of breathing appear, the artificial respiration can be stopped for a time, whilst hot blankets are wrapped round the body and the limbs are rubbed briskly towards the heart, and as soon as the patient can swallow, give him hot coffee or bovril or milk. Watch the child carefully to see that breathing does not again stop; if it does, begin artificial respiration again.

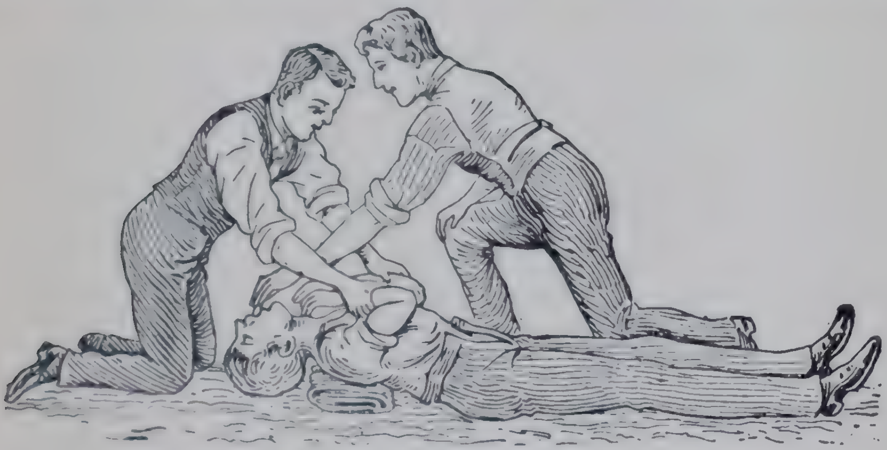


Fig. 90. Expiration

(From *First Aid.* St. John Ambulance Association)

Poisons. 1. Find out the nature of the poison and save any remains.

2. Send for the doctor at once, telling him as much as you can about the case.

3. If the lips and tongue are swollen, blistered or covered with white patches and the child finds it hard to breathe or swallow, do *not* give an emetic, because the poisoning is

due to acid or alkali, both of which burn and lacerate the mouth, gullet and stomach, so that the strain of vomiting might fatally injure the already weakened tissues.

(*a*) If alkali (strong ammonia, caustic soda or potash, etc.) has been swallowed, give vinegar and water to neutralise it.

(*b*) If acids (e.g. nitric, sulphuric, hydrochloric, oxalic acids) have been swallowed, give bicarbonate of soda or washing soda in milk, to neutralise the acid. In both cases follow up the antidote with a soothing drink of olive oil and milk.

4. If there be no signs of burning of the mouth, give an emetic (one dessertspoonful of mustard or one tablespoonfu of salt in a tumbler of lukewarm water, or, for a little child a teaspoonful of ipecacuanha wine every fifteen minutes). After sickness has been thus induced, give a soothing drink as above.

5. If the child be very sleepy, he has probably taken a narcotic, such as opium, morphia, laudanum, chlorodyne etc., and must be kept awake at all costs, as otherwise he may become unconscious and die. Hence, walk him about, give strong coffee, pinch him, in fact resort to any means you can think of to ward off sleep.

The Emergency First Aid Case. No school is properly equipped without such a case. It need not cost more than a few shillings, and should contain the following articles :

1. Triangular bandages.
2. Roller bandages, of different widths.
3. Cotton-wool.
4. Lint.
5. Sticking plaster.
6. Safety pins.
7. A camel-hair brush.
8. Tape.
9. Scissors.
10. Fine tweezers.
11. Watch-key.
12. Several pads, of variou sizes.
13. A stick (for tourniquet)
14. Several splints.
15. Carron oil.
16. Vinegar.
17. Bicarbonate of soda.
18. A two per cent solutio of iodine in alcohol.
19. Olive oil.
20. Salt or mustard.
21. Spoons of various sizes.

CHAPTER XXVII

SPECIAL SCHOOLS

Mentally defective—Epileptic—Backward classes—Blind and deaf—Partially blind and deaf—Sanatorium schools—Open-air schools—Cripple schools.

1. **Mentally Deficient.** These schools were made *permissible* under the Elementary Education (Defective and Epileptic Children) Act, 1899, and compulsory under the Elementary Education (Defective and Epileptic Children) Act, 1914. These Acts state that the provision may be in the form of special schools or special classes in an ordinary school.

Character of the Education. (1) The school should be on the outskirts of the town, so that there may be a large playground, and it should be of the open-air type, where gardening is possible. Till now, they have mostly been placed centrally, but facilities for transit are now much improved and largely do away with the objections to an outskirt position.

(1) *The curriculum* should provide adequate physical education by means of training in personal hygiene, games and physical exercise. Each child should have a towel, brush and comb, and tooth-brush. Shower baths should be installed. A midday meal is desirable both from the physical and the educational point of view. (2) *Mental Education* should be very practical and manual, since these children show much more aptitude for practical pursuits than for acquiring abstract ideas, and physiologists hold that brain-development is encouraged by this means. Direct and formal intellectual instruction is of little use, but children should be taught objectively and incidentally to read, write and count if possible, but if they prove incapable of this it is best not to waste time over it. They may still succeed at handwork

but if this too is impossible they should be dismissed from school. Special attention should be given to speech-training, for most of the children have speech defects. (3) *Manual Work.* At least half of the school time should be given to it, and from fourteen to sixteen years of age children should specialise in one form by which they may earn a living. Such manual work should be chosen as will stimulate the faculties by securing the interest of the children. Often much time is given to making objects of no practical interest to children, because they could not find a useful place in their own homes. On the other hand, the making of clogs, boots and their own clothes, etc., has much more value as a mental stimulus, and in some special schools, e.g. Bristol Street, Birmingham, this principle is acted on.

General Regulations. (1) The Board of Education recognises three kinds of arrangement : (i) Day schools ; (ii) boarding schools ; (iii) homes used for boarding and lodging children taught in (i). (2) *Admission and retention.* Every child must be certified defective before admission. Children are not admitted under five nor kept after sixteen, nor if incapable of profiting by the instruction. (3) The duration of the school-meeting must not be more than two and a half hours, and there must be at least one and a half hours' interval between the morning and afternoon meetings. (4) *The curriculum* must include English language (speaking, reading, writing), arithmetic, knowledge of common things, including nature study and observation, drawing, singing, physical exercise, sewing and manual instruction, suitable forms being :

(*a*) *Younger Children.*

Bead-threading.
Paper folding.
Paper tearing.
Paper cutting and mounting.
Paper mat making.
Wood strip work.
Drawing.
Clay modelling.
Macramé work.
Netting and other string work.
Kindergarten sewing.
Pith cane work.

(*b*) *Older Boys.*

- Drawing and design.
- Woodwork and carpentry.
- Tailoring.
- Shoe-making and repairing
- Cardboard modelling.
- Chair caning.
- Gardening and farmwork.
- Household employments.
- Mat and rug making.
- Repoussé.
- Bent iron work.
- Printing.
- Baking.
- Basket work.

(*c*) *Older Girls.*

- Cookery.
- Laundry.
- Housewifery.
- Needlework.
- Knitting.
- Mending.
- Machine sewing.
- Drawing and design.
- Basket work.
- Chair caning.
- Gardening.

(5) *Size of class.* The maximum number of children per class is twenty, unless there are more than two classes in the school, in which case the maximum number is twenty-five, except in the two lowest classes. (6) *Buildings.* (*a*) Schools for various types of afflicted children must not be in the same building unless structurally separated. (*b*) There must be fifteen square feet of floor space per child. (*c*) Single desks must be provided. (7) *Boarding-out of Children.* (*a*) No child can be boarded out without the parents' consent. (*b*) Except in the case of brothers and sisters, not more than one child is to be boarded in the same house. (*c*) No child is to be boarded out in a home in which there are more than four children, counting the defective child. (*d*) Each child is visited monthly by a member of the Boarding-out Committee.

Existing Provision. In 1930 there were 171 special schools in England and Wales, accommodating 17,000 feeble-minded children, i.e. the great majority of such children were in the ordinary day-schools. The ideal for the lower mental grades is the residential school, which is part of a Colony, such as Sandelbridge Home, Great Warford, Cheshire, so that children may continue under life-long supervision. If they are turned loose in the world at sixteen, they deteriorate rapidly; many drift into workhouses before thirty; many of the women have large families of illegitimate children who inherit the mental defect of the parent, i.e. the money spent in education is wasted. It was the realisation of this fact that brought about the passing of the Mental Deficiency Bill in 1913, which legalises *permanent care* of the feeble-minded.

2. **Epileptic Schools.** Here the Board only recognises boarding schools. Eighty per cent of epileptic children are unfit for the ordinary school for the following reasons: (1) They are generally dull, even in facial expression. (2) They are often unduly emotional. (3) Speech is usually indistinct and defective and acquired late. (4) Fits occurring in school place undue strain on the teacher and on the other children. On the other hand, education is very necessary to stop the mental deterioration which usually sets in. At present six epileptic schools exist, accommodating 609 children; 6,430 epileptic children exist, excluding London. The school should form part of a Colony, partly to prevent marriage, since epilepsy is strongly hereditary, and "many are also said to give the reaction for syphilis" (Kerr). Gowers found that fifty per cent of the children of epileptics were epileptic. Also, instead of being epileptic, they may be mentally deficient, i.e. considerably more than fifty per cent are either epileptic or mentally defective. The *regulations* are much the same as for mentally defective schools, but more subjects must be taught, viz. composition, history, geography, literature, and the manual work can be more advanced and must be chosen with a view to (1) training the manual and mental powers. (2) Fitting the child to earn a living. Care must be taken to avoid dangerous tools.

3. **Backward Classes.** (See Chapter XII.)

4. **Special Schools for the Blind and Deaf.** There were 131 of these schools in England and Wales in 1930, accommodating 9,443 children. The general regulations are much as for the mentally defective and epileptic. The curriculum includes all the usual school subjects, but the time demanded for manual instruction is less; a minimum of four hours weekly is necessary. The deaf are to be taught by the *oral* method where possible. Fifteen is the maximum number for

a blind, and ten for a deaf, class. The blind and deaf must be taught separately.

Forms of manual work suitable for defective and epileptic are also suitable for the deaf, with the addition of dressmaking, corset making, lace making and baking. *For blind* (*a*) *younger children :* Mat plaiting, bead-threading, lacing, clay modelling, knitting, netting and string-work, straw plaiting, rug and mat making, pith cane work. (*b*) *Older boys :* Clay modelling, basket work, chair caning, brush-making, woodwork, bent iron work. (*c*) *Older girls :* Sloyd needlework, needlework, knitting, mending, chair caning, basket work, brush-making. For methods of educating the deaf see Chapter XV.

5. Of more interest possibly to the ordinary teacher are the classes for the semi-deaf, and semi-blind (high myopes) which have been started recently in a few places. Classes in London, Bristol and elsewhere provide for the instruction of the semi-deaf, and several Authorities provide for the semi-blind. (See Chapter XIV.)

6. **Sanatorium Schools.** The Finance Act of 1911 set aside £100,000 for sanatorium schools for children suffering from tuberculosis. The Local Government Board distributed the money, but the Board of Education approved the plans for education of the children. In 1928 there were nine day and thirty-six residential sanatorium schools. In them, everything is done in the open air, and the lesson-time is only half what it is in the ordinary schools ; in spite of which the children keep up to their standard. It is much better that children who need sanatorium treatment should also continue their education for two reasons : (*a*) They are happier if occupied. (*b*) They are fitted to earn a living. On leaving, they should go to an open-air day school.

7. **Open-air Education.** A good many Education Authorities now provide for this in some form or other. (1) Sometimes it is in the form of playground classes. In London, and elsewhere, the bandstands in the parks have been used for this purpose for some years. (2) Another plan is the organisation of school-journeys, by means of which children get country holidays, varying from one day to two or three

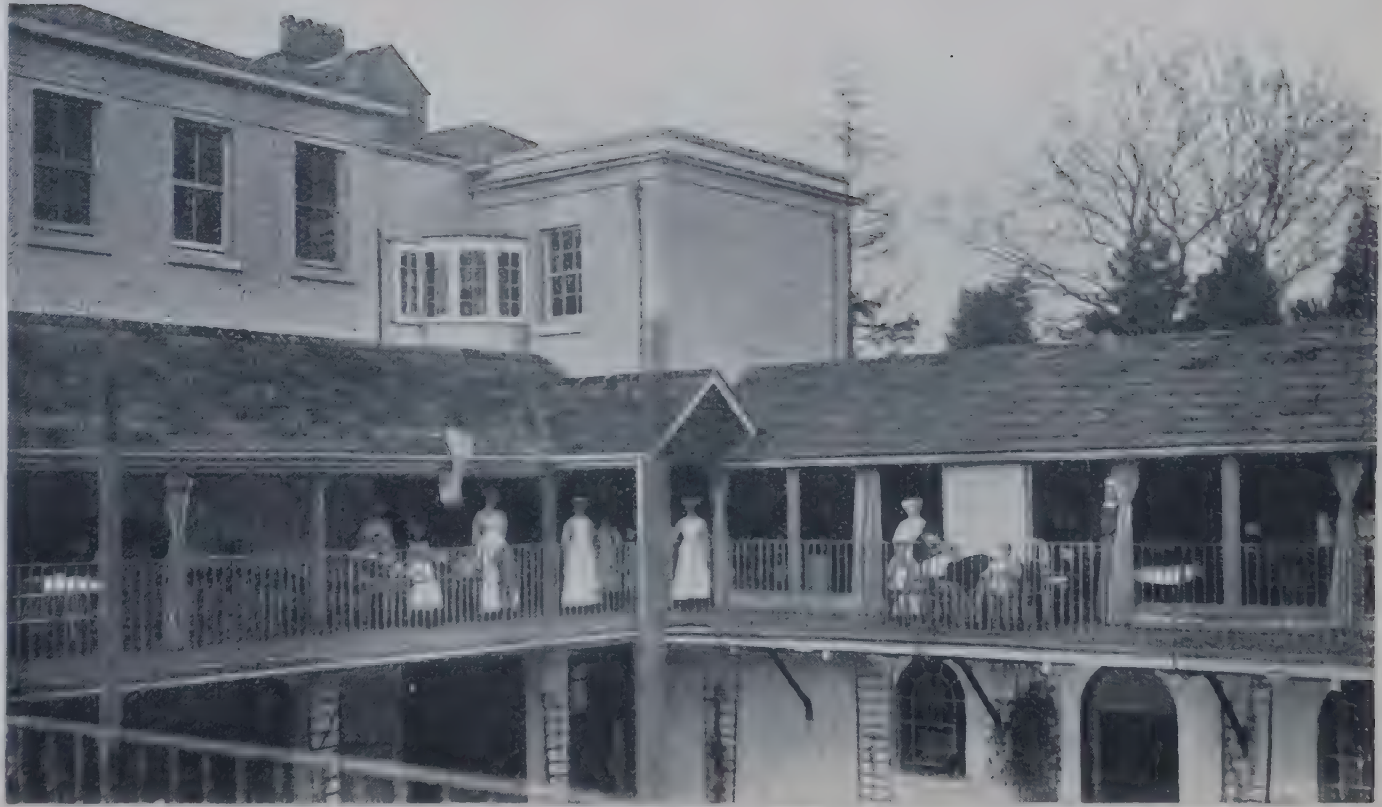


Fig. 91. Woodlands Sanatorium School, Birmingham

weeks, during which they are also taught. (3) In many areas open-air class-rooms or schools have been started. In 1928 there were sixty-two day and thirty-eight residential open-air schools of recovery for the education and treatment of children suffering from severe debility or other defect of similar nature. All these show good results in increased health and vitality, and it is very desirable that there should be wide extension of this type of education, specially for delicate and debilitated children. The following accounts appeared in *The Times Educational Supplement* during 1918 and indicate the kind of work being done.

1. "The Children's Care Committee of the *Coventry* Education Committee have recently reported on the work done by them last year on behalf of delicate and ailing children. An open-air class for weakly children was held at one of the council schools in the town from 30 April to 12 October, the average weekly attendance being twenty-eight, and during that period 2,935 meals were supplied, or an average of 147 per week. In addition to a cup of cocoa, soup, etc., supplied in the middle of the morning, each child attending the class had a substantial two-course dinner every day, the cost of the food amounting to £71 7s. 9d., towards which the parents made a contribution of £43 15s. Two classes of this kind are being held during the present season, with specially appointed teachers, who will be paid at the rate of £10 per annum beyond the ordinary scale, and the purchase of additional necessary equipment has been sanctioned.

In addition to the open-air class, an open-air camp was opened on 6 May, and kept open until 30 October, and thirty-nine children (twenty-three girls and sixteen boys) were admitted at various times, and stayed for periods varying from three to twenty-five weeks. Each child was weighed on admission, and at frequent intervals during his or her stay, and all children showed considerable increase in weight, one girl increasing to the extent of eighteen pounds in the course of her time at the camp, the average increase being half a pound per week. The Care Committee thought it very desirable that, in one form or another, the camp should be

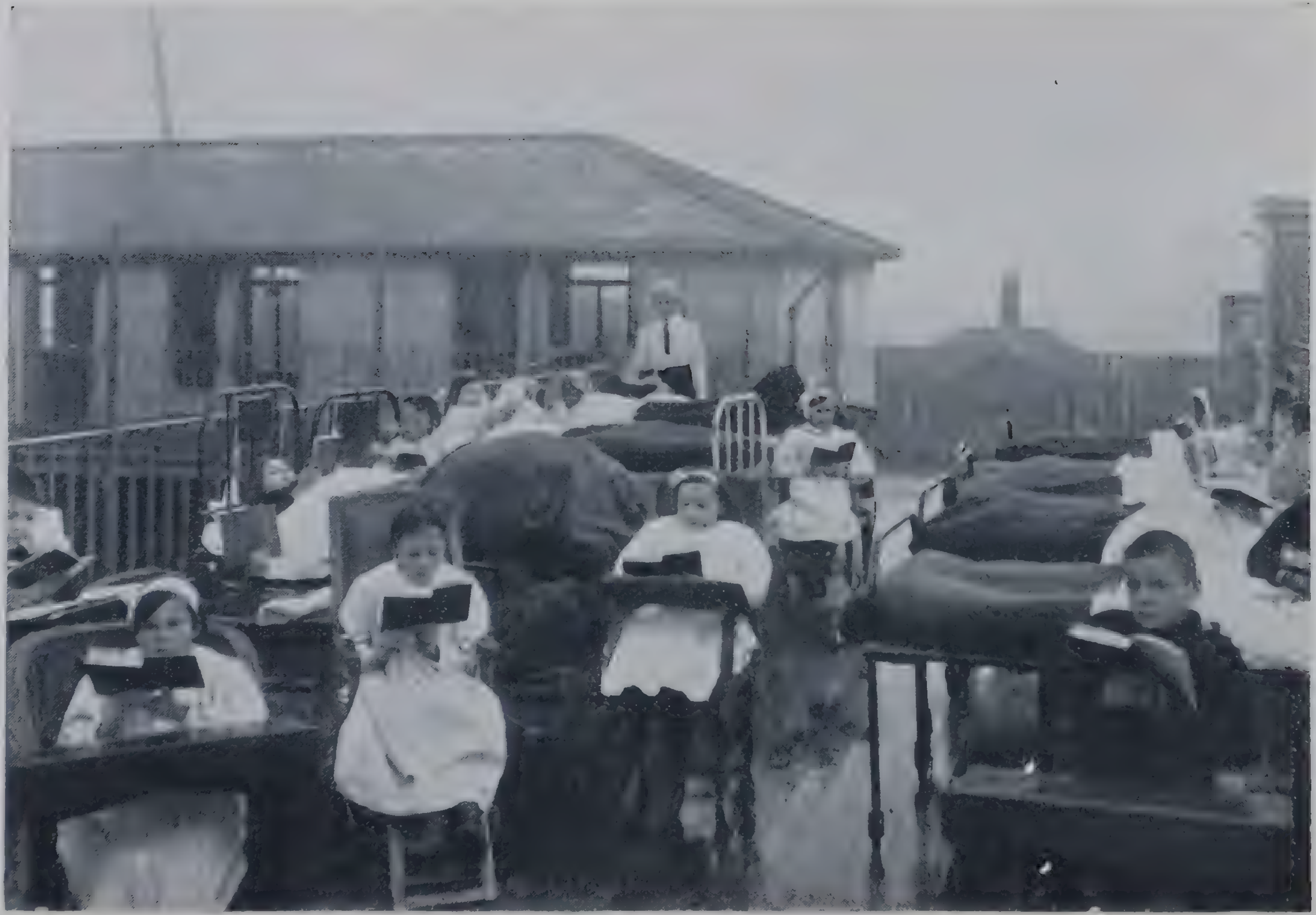


Fig. 92. Woodlands Sanatorium School, Birmingham

Reproduced by permission] [Messrs. Bateman and Bateman, Architects, Birmingham resumed during the present summer, in spite of the difficulty of the food supply, and it was therefore decided to resume operations on the same lines as last year, and the Education Committee have made a grant towards the expenses of £250 for the financial year ending 31 March, 1919."

2. "The *Plymouth* Education Committee have taken a further step forward in their plans for the provision of an open-air school and are proceeding with the establishment of a day school of this kind with accommodation for 200 children, it being felt to be important that the scheme should be started whilst the weather is most suitable for the gradual acclimatisation of the children to open-air conditions. The plan decided upon is to rent a suitable building with a site of from four to eight acres, using the existing building for administrative purposes and for the staff, and avoiding expensive structural alterations. In the grounds, open-air class-rooms, mainly of wood, are to be erected, each sufficient to accommodate twenty or thirty children, all the sides of the class-rooms made to be opened or closed according to atmospheric conditions, so that on fine days children working under cover will have the benefit of fresh air from every side. It is hoped to erect fairly substantial shelters so that the school can be carried on all the year round, and they will be readily portable, so that they can be moved when a permanent site is ultimately obtained. In addition to the class-rooms a shed will be built to be used for resting and as a dining-room, and for assembly and marching on wet days. Three plain but nourishing meals will be provided by the Education Authority each day, the cost of which will be repaid by the parents in whole, or in part, according to their respective means. The equipment of the school will be upon the simplest lines, and the chairs in the class-rooms will be of such light construction that each child will be able to move his own chair to the various places where it will be used. Much of the simpler school equipment will be made in the school workshop when the work is properly established.

Admissions to the open-air school will be determined by the Medical Officer, and no boy or girl will be admitted who is unable to undertake two sessions of school work each day.

For the present it is suggested that the minimum age shall be fixed at seven years, and all children will be under the constant supervision of the school Medical Officer whilst in attendance at the school, and they will be kept at the school until there appears to be a lasting recovery, the average stay being, perhaps, about six months, although the period of attendance will vary in individual cases. The approximate cost for the erection and maintenance of an open-air school of this kind for 100 and 200 children respectively is estimated at £1,570 and £2,835 for establishment charges, and £2,570 and £4,480 for annual maintenance charges, including all rent, salaries, cost of meals, etc. As against these charges the amounts received would probably be about £1,360 or £2,720 for 100 or 200 children respectively, composed of a Board of Education grant at £4 per child and parents' contributions towards food."

3. "*London.* The fact that the Council has, at the present time, only two open-air schools is due to a variety of causes chiefly arising from the special and peculiar needs of an open-air school. Many proposals have been made for the establishment of such schools, but on examination and inquiry it has not been found practicable to adopt any of them.

It may be added that a provisional sum has been included in the estimates for the current year for the establishment of additional schools, but, in view of the difficulties as regards labour and materials and the shortage of teaching staff, it is very improbable that this money will be spent during the year.

On the other hand, the Council has inaugurated and developed a system of open-air or playground classes. A large number of such classes have been held during the summer months (usually from about the beginning of May till about the end of October) in connection with the elementary schools maintained by the Council. These classes are held either in parks or open spaces or in the school playgrounds. In 1914 the number of such classes was more than one hundred, but owing to various causes resulting from the war this number has declined to fifty-six.

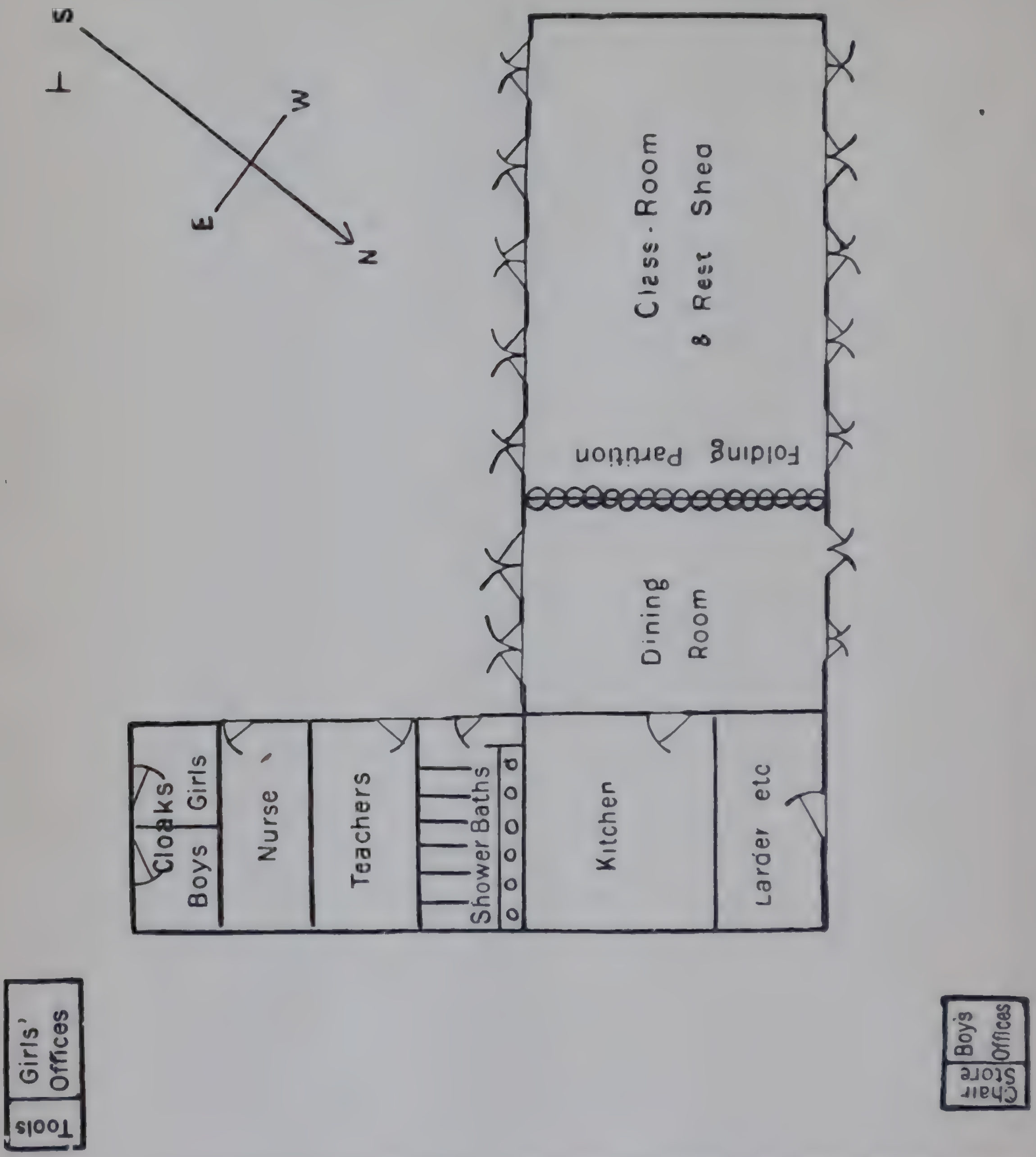
It should be added that the Education Committee of the

Council have recently had under consideration the whole question of the education and treatment of tuberculous and pre-tuberculous children and of children needing open-air treatment, and that a Joint Sub-Committee of the Education and Public Health Committees of the Council has been appointed to consider the matter and submit recommendations with a view to the settlement of the principle of dealing with these classes of children."

As an illustration, I will describe rather more fully, the open-air school at Knowle, a suburb of Bristol. The school was opened in 1913, as the result of private philanthropy and enterprise, its supporters hoping that the Education Committee would take it over when it had demonstrated its utility. The school is built on a hill, on the edge of the town, so that on one side it overlooks beautiful country, as the illustrations show. It is just at the end of a tram-line connecting it with the city, and this is of importance, as it enables children to come from all parts of the city by tram. The children collect on Bristol Bridge at 8.30 a.m. and are there met by the school nurse, who accompanies them for the rest of the journey to school.

With regard to the building, I cannot do better than quote the description published at the opening of the school : " In planning it, an endeavour has been made to obtain the maximum amount of sunlight and air and yet to screen the class-room and rest-shed, as far as possible, from cold winds. The building is therefore schemed in the form of the letter L, with the dining-room, class-room and rest-shed facing a little south of S.E. and screened by the administrative portion of building which faces N.E. The school comprises a class-room, and rest-shed fifty feet by twenty-five feet, dining-room twenty by twenty-five feet, bathroom, nurses' and teachers' rooms, clothes store, boys' and girls' cloakrooms and offices, kitchen, larder and stores for fuel, rest chairs and tools.

The dining-room, class-room and rest-shed obtain direct sunlight during the whole of the day, and all other rooms used by the children during some portion of the day. The S.E. side of class-room and rest-shed is open, the end and N.W. side being enclosed and fitted with windows and French


S
T
W
E
N
Class-Room
& Rest Shed
Folding Partition
Dining Room
Cloaks
Girls
Boys
Nurse
Teachers
Shower Baths
Kitchen
Larder etc
Girls' Offices
Tools
Boys' Offices
Chair Store

casements respectively. (Subsequently it was found necessary to supply French windows on the S.E. side also, as the winds in winter were so violent.) Opening fanlights, carried up to the full height of the room, are fitted over the French casements, so that on all of these being thrown open, the class-room and rest-shed become practically an open shed. The dining-room is fitted with similar doors and fanlights, and thorough cross-ventilation is obtained by the use of the latter, the doors being closed during very inclement weather. The dining-room is divided from the class-room and rest-shed by a swivel-hung glazed partition, which folds back to each side of the room, thus obtaining an unimpeded floor space of 1,750 square feet.

The bathroom is fitted with the necessary dressing cubicles and six shower baths, a mixing valve fitted with a thermometer being provided on the service pipes, so that baths of any desired temperature can be given. The advantage of shower baths over slipper baths is that the risk of contagion is reduced to a minimum. Hot water is also laid on to the lavatory basins in the children's cloakrooms, a rather unusual provision in schools.

The walls of the building are constructed of timber framing on a brick foundation, the framing being boarded and felted and sheeted on the outside with weather-boarding; all exposed timber (including internal joinery) is treated with solignum preservative. The roofs are boarded and felted and covered with sand-faced pantiles. All the floors are jointless, and the material is brought four inches up the walls to form a curved skirting, thus enabling them to be hosed down if desired. With the exception of class-room and rest-shed, all internal walls are plastered and distempered, or finished in enamel."

Accommodation. The school provides for sixty-five children, but there were eighty-eight on the books when I last visited it, and there is always a waiting-list.

Duration of stay. There is no fixed time limit. The children stay as long as the doctor considers necessary.

Payments by parents. These vary with the circumstances of the parents.

Holidays. Saturday and Sunday are holidays, but there are no "long" holidays, the teachers taking their holidays in rotation.

Selection of children. This is done by the school doctors, and the cases included, at my last visit, malnutrition, debility, anæmia, old chorea, pre-tubercular, tubercular glands, convalescents from phthisis, tubercular enteritis, asthma, bron-

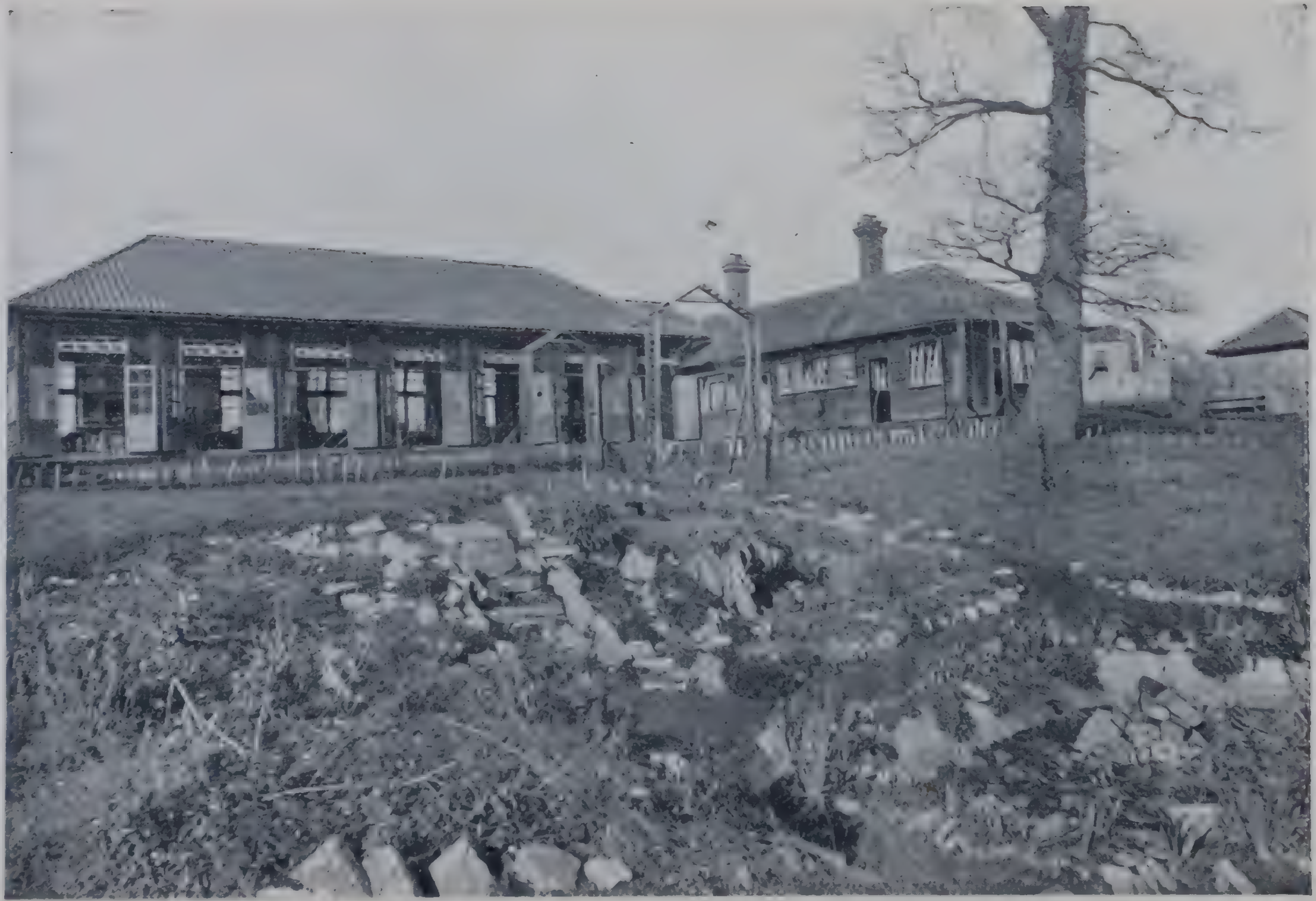
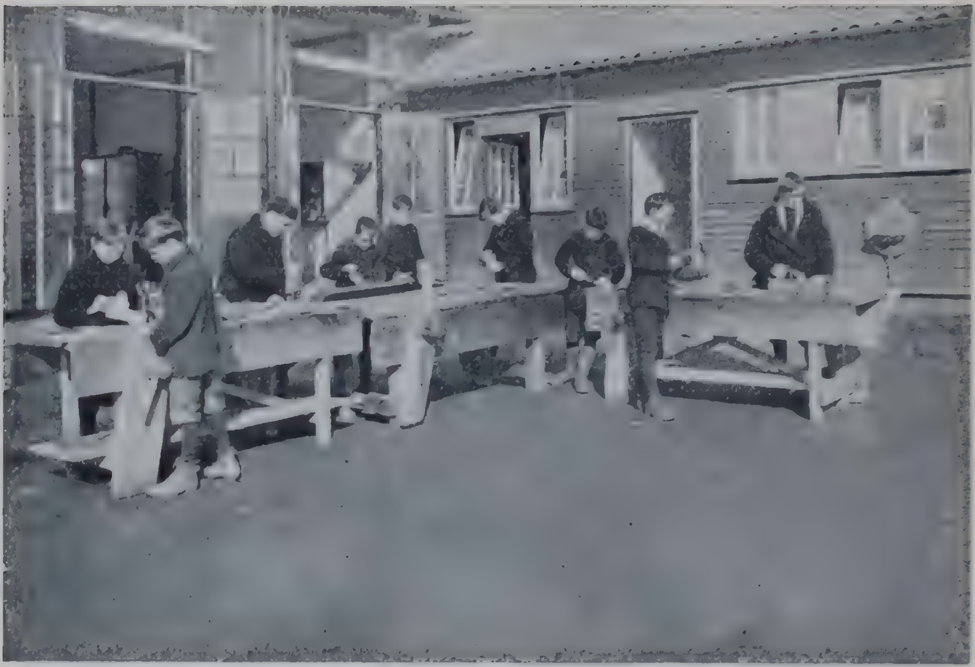


Fig. 94. Bristol (Knowle) Open-Air School

Figs. 95-96. Classes working out of-doors: Bristol Open-Air School



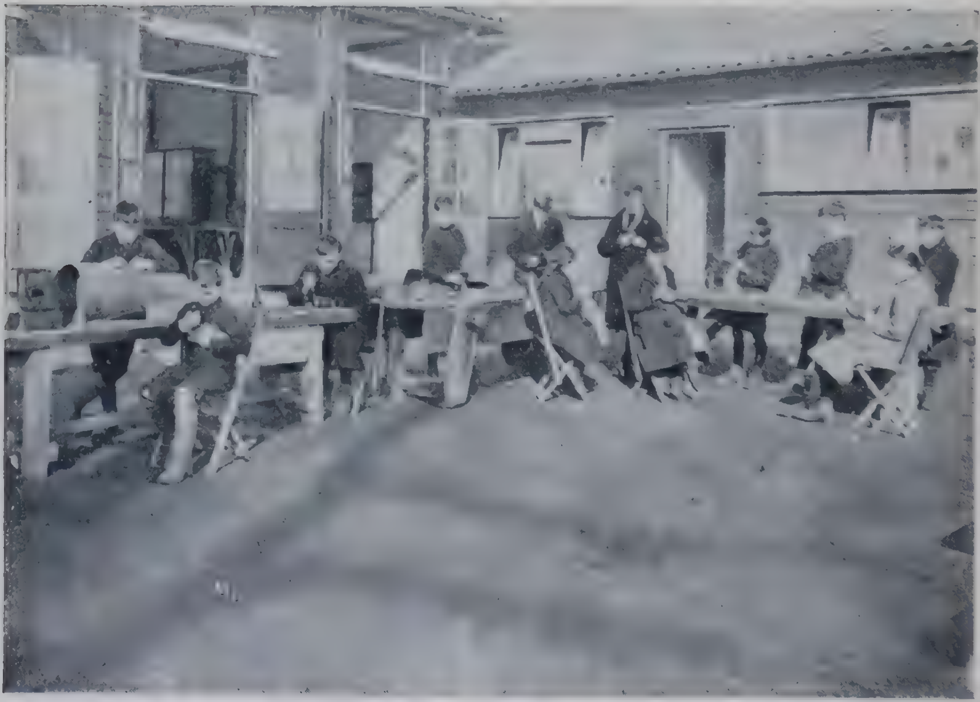


Fig. 97-98. Classes working out-of doors : Bristol Open-Air School

chitis, empyema, heart disease, lateral spinal curvature. Cases of open (or infectious) tuberculosis are not admitted.

The curriculum lays stress on (1) physical exercise, especially on breathing exercises which are done twice daily for five minutes. (2) Manual work, which occupies six hours weekly and includes gardening, woodwork, basket and raffia-work, etc. (3) Nature study.

Meals. Though a day school, three meals are provided, viz. breakfast, dinner and tea, after which the children go home. Tea-time is varied so that the children get away in daylight. In addition, children for whom the doctor orders it, get milk at 11 a.m. After dinner there is a two hours' rest on camp-bedsteads in the garden if possible. The menus of meals are extraordinarily varied and appetising and the cost is as extraordinarily low, owing to the excellent management of the catering. It was only 2s. 2½d. per week per child before the war.

Medical side. The doctor and dentist both visit the school weekly. The children are weighed once a fortnight, and bathed weekly, under the supervision of the nurse. Teeth are cleaned daily, after dinner.

Clothing. The school supplies rugs, coats, clogs and stockings, so that the children can have extra clothing in school, if necessary.

Cripple Schools. In 1930 there were seventy-three schools for the education of children suffering from crippling defects or weak hearts for which no specific treatment (other than remedial exercises and associated treatment) is provided. In addition there were forty-five hospital-schools for the education and treatment of crippled children, and eleven schools for convalescent cripples.

There has been a great growth of interest in the subject quite recently, and schemes have been set on foot in many parts of the country for treating crippled children.

Cost of Special Schools. The cost per child in an ordinary elementary school in 1927–28 was £11 15s. 4d. The cost of a blind child is £29 in a day and £88 in a residential school. The cost of a deaf child is £43 in a day and £82 in a residential school. The cost of a mental defective is £25 in a day and £71 in a residential school. These figures (which exclude loan charges) show the heavy cost to the community of the special schools and one of the reasons why there are not more of them.

Fig. [illegible]. After-dinner sleep : Bristol Open Air School

CHAPTER XXVIII

WELFARE OF INFANTS AND YOUNG CHILDREN

Reasons for attention to this subject: knowledge derived from medical inspection, infant mortality, birth-rate — Health visiting — Maternity and child-welfare centres—Day nurseries—Nursery schools—Schools for mothers—Training of elder girls in the care of infants and young children.

Welfare of Infants and Young Children. The attention being paid to this subject nowadays is the result of various factors, e.g. (1) the knowledge derived from medical inspection of school children, which has demonstrated that children enter school with a large number of physical defects due to *earlier* conditions, such as summer diarrhœa, measles, whooping cough, respiratory disease and rickets. These conditions, or at least the *seriousness* of their results, are often due to ignorance or *neglect* on the part of the mother, or to ill-health of the expectant mother, e.g. what can be said of the maternal instinct of the mother who feeds a baby under one year old on " chips and a sup of beer." (Quoted by Dr. Fraser, Chesterfield.) (2) *The study of infant mortality statistics*, e.g. in 1900, the mortality was 15·4 per cent under one year, of all births. In 1912, the mortality was 9·5 per cent under one year, of all births. (The general death-rate for all ages = 1·3 per cent.) These numbers emphasise two facts: (*a*) The very high death-rate in babies compared with other people. In this connection one must remember that probably almost as many lives are lost from what is called " ante-natal " death (abortions and still-births). (*b*) The very considerable *fall* in infant mortality in the twelve years between 1900 and 1912. This fall, by the way, went on till the war began, but then infant mortality increased again, e.g. in 1915 it was 11 per cent, and the actual number of deaths in that year was 89,477 under one year old, and 55,607 at ages one to five year. Since then, however, it has again fallen to 7·4 per cent in 1929. Along with the very satisfactory fall in infant mortality which began in 1900, there also is a marked fall in the *birth-rate*, from 2·9 per cent of the population, to about 1·63 per cent in 1929, and this has helped to concentrate public attention on infant mortality. (3) The war has made the whole country realise the value, nationally, of our babies, e.g. this is the one Government Department which is not urged to economy.

Decline in the Birth-rate. (From Dr. Newsholme's *New Tracts for the Times.*) This may be due to (1) postponement of marriage to a higher age. This has occurred, for in 1896 the average was 25·08, and in 1909 the average age was 25·73, but this is not enough to account for more than a tiny fraction of the decline in births. (2) Decrease in the proportion of women aged fifteen to forty-five. (3) Decrease in the proportion of women who marry. But, as a fact, the proportions have gone up in both these cases in the last fifty years. (4) Reduced fertility. This has occurred markedly in the last twenty-five years, and is largely volitional. It is not so in countries where the influence of the Roman Catholic religion is strong, because this Church bans preventive measures against child-bearing, e.g. Ireland ; French Canada.

Causes of the reduced Fertility. It might be due to more sterile (childless) marriages or to smaller families. All statistics, however, point to the latter as the cause. *Cause of the smaller family.* Here there are various possibilities, e.g. poverty, industrial conditions, spread of the knowledge of how to limit the size of families, unselfishness on the part of a parent who realises that the income will not support more than a few children at the higher standard of comfort which many classes now aim at. This merges into *selfishness* of the parents who *could* support a pretty large family, but won't because the mother objects to the interference with her liberty entailed by children, or both parents know that it may mean fewer *luxuries*—not necessities. This last is one of the deplorable features of our modern social state—and is on the increase. As Dr. Newsholme says, "The ideal of portions of the community, especially of a large proportion of that part of it which has sufficient or abundant means, is one which is almost pagan in its outlook." "Their sense of communal responsibility is undeveloped." "Over prosperity may imply a serious moral danger. While among the artisan classes and among the even harder-pressed lower ranges of the commercial and professional classes there may be economic reasons tending towards restricted families, the same excuse cannot be urged for those in easy circumstances."

Fertility in relation to Social Status. Dr. Heron, in a Drapers' Company Research Memoir, concludes that in the last fifty years the relation between undesirable social conditions and a high birth-rate has almost doubled itself; and from a study of the *unequal* distribution of decline in the birth-rate, Professor Pearson concludes that "the mentally better stock in the nation is not reproducing itself at the same rate as of old, the less able and the less energetic are the more fertile, for the last forty years the intellectual classes of the nation, enervated by wealth or by love of pleasure, or following an erroneous standard of life, have ceased to give in due proportion the men wanted to carry on the ever-growing work of the Empire." One must remember, however, that the contribution to a future generation depends on the excess of *births over deaths*, and is not necessarily directly proportionate to birth-rate.

Possibilities of Action. (1) Prevention of marriage amongst the unfit, whose defects have been proved hereditary, e.g. mental defect, certain forms of epilepsy, venereal disease. (2) Development of public opinion, which has an undoubted effect on individual conduct, e.g. in discountenancing luxurious and extravagant habits and the uncontrolled desire for "society" and pleasure. (3) The lowering of some parents' standards as to what "providing for" their children means. Inheritance of money is a doubtful blessing.

Causes of the Decline in Infant Mortality since 1900.

1. *The Midwives Act*, 1900, regulates the practice of midwives, who attend more than half the total births in England

and Wales. Under this Act, the County or Borough Council is responsible for (1) supervision over all midwives. (2) Investigation of charges of mal-practice, negligence, etc., on the part of a midwife and reporting to the Central Midwives Board. (3) Suspension of any midwife from practice if this appears necessary to prevent the spread of infection. (4) Keeping a register of names and addresses of all midwives.

2. *Notification of Births Act*, 1907, extended to all areas in 1915. (1) The father, if living in the house at the time of the birth, and any person attending the mother at the time of or within six hours of the birth, must give written notice of the birth to the Medical Officer of the District, by posting a prepaid letter or card to the Medical Officer of Health at his office or residence, within thirty-six hours of the birth, or by delivering the same. The Local Authority shall supply forms to any doctor or midwife who applies for the same. (2) Anyone who fails to give notice of the birth is liable to a fine of not more than £1. (3) This notification is *in addition* to the requirements for *registration* of births.

3. *The spread of knowledge of infant care*, through the elementary school, the health visitor, the baby clinic, and so on.

Causes of Infant Mortality.

1. Pre-natal	25%	(abortions, still-births).
2. Wrong feeding	30%	(chiefly epidemic diarrhœa, or enteritis).
3. Lung disease (Bronchitis, pneumonia, consumption)	18%	
4. Measles and whooping cough	7%	
5. Various	20%	(Chiefly immaturity and congenital defects, due partly to maternal physique or disease).

‘ Further one must remember that the conditions which kill so many children, maim and disable many of the survivors, and these swell the ranks of those who die in early childhood or survive with greater or less degree of defect or disability.”

Relative number of Boys and Girls.—The average births of boys : girls = 1,052 : 1,000, but in the first two years of life there are so many deaths amongst boys that the result is more girls than boys.

Remedies. It is possible to prevent a large amount of this waste of life. One authority states that "there is no insuperable difficulty in reducing the total deaths in childhood to half their present number," and calculates that if we had looked after our infant life for the last forty years, we should now have another 1,300,000 men between eighteen and forty available for the Army. Two arguments are sometimes brought forward in favour of letting things be as they are, viz. (1) that nature kills off the weakest, who would be of no use to the nation. (2) That we should become over-populated if all the babies lived. Now the answer to the first is that it is true, but the survivors also are injured, i.e. the fit are less fit. The answer to the second, according to Mr. Samuel, the late Home Secretary, is "that there is no ground whatever for thinking that our population of 45,000,000 is all that these islands could hold. If we were to deal with the problem of overcrowding in a rational fashion and spread the people over a larger area ; if adequate systems of town-planning were pursued still further, and there were an extension of garden cities and garden suburbs, imagination could hardly see the number of persons whom this country could healthily accommodate." He also stated that a scheme of remedy should consist of the following parts :

(1) An arrangement for the local supervision of midwives. (2) Arrangements for an ante-natal clinic for expectant mothers, and a system of visitation. (3) A maternity hospital, or beds at an existing hospital, where complicated cases could receive treatment. (4) Post-natal work, arrangements for treatment of complications after birth, advice and treatment for infants up to school age, and visitation at homes of infants not at school. Mr. Samuel added that this was a very large and comprehensive scheme, which could only be gradually worked up to. It was an ideal at which to aim, and no authority would have completely done its duty in this regard until it had established every part of that scheme.

The foregoing is the business of the Local Government Board, but in addition the Board of Education has a part to play, viz. that of *educating* mothers and children in the care and management of infants and little children. In November, 1915, the Local Government Board issued a Memorandum drawn up by Dr. Arthur Newsholme, their Medical Officer, on *Health Visiting and on Maternity and Child Welfare Centres*. In this he states that measures for improving the health of mothers and their children under school age mainly fall under two heads: Home visits and attendance at a Centre—and that the work at the Centre can only be satisfactory if accompanied by organised health-visiting. This again depends on full use of the information got from notification of births, so that early visits can be made to every house in which a birth has occurred, suitable advice given and the mother recommended to bring the baby to the Centre, if one exists. Usually about one-quarter of the mothers visited will visit the Centre, i.e. for the majority the only chance of giving hygienic advice is the *home-visit*. This is even more the case in rural areas, where Centres are impracticable. A Government scheme has the advantage over that of Voluntary Societies in that the latter nearly always consist in the establishment of a Centre and the home visiting of mothers and infants who attend the Centre, but though this is valuable, it lacks the completeness possible if worked in conjunction with notification of births. At present nearly all Sanitary Authorities of districts with population more than 20,000 have started a system of health visiting, and a considerable number of smaller authorities have done so. Many County Councils have organised county systems of health-visiting. The work should always be directed by the Medical Officer of Health.

Qualifications of Health Visitors. The three most useful qualifications are those of (1) a trained nurse; (2) a certified midwife; (3) a sanitary inspector.

Number of Visits. Usually a visit is paid within two or three days of the notification of birth, and if possible it should be so arranged that the health visitor can consult with the midwife before the latter ceases her attendance. In some homes no visits are needed, though there is reason to believe that the wives of many of the prosperous classes would welcome and profit by the visits, if the staff of visitors were large enough to make this possible. About eight visits are needed in the first year, but they should be continued up to school age. It must be remembered (1) that mothers who may be regarded as well educated do not necessarily understand the management of an infant and may and probably will welcome detailed instruction. (2) For many mothers advice given *once* only has very little value. It needs reiteration, and it *must* be personal.

Work of the Centre. The same Centre should be used for mother and baby, because the welfare of the two cannot safely be considered separately. About forty per cent of infant deaths occur within one month of birth and are due largely to the mother's health before the birth. Also during the period of breast-feeding the child's health is directly dependent on that of the mother, and even after this period it is likely to vary with that of the mother, which necessarily affects the care she can give the child. Hence the work of the Centre must be both *pre-natal* and *post-natal*, and must take the form of medical advice and treatment, especially of minor complaints when local circumstances show the need. At the best Centres, each mother and child is seen at definite intervals, every four or six weeks, or oftener if the health visitor finds the baby is not getting on. After the first few months the children do not need to be seen so often, and after it is two or three years old, once a quarter or twice in six months is enough, until the child is entered on the school register. Largely, the post-natal work of the clinic resolves itself into weighing, and advice as to food and general hygiene. *The ante-natal work* of the Centre should aim at the removal of factors adverse to the health of the expectant mother and to seeing that the confinement takes place under favourable conditions.

For older children, i.e. those over one year, further provision is made in the following ways, in various places :

1. **Day Nurseries or Crèches,** for the children of mothers employed away from home. These owe their existence to philanthropy and till 1914 were not State-aided. Now they

get grants from the Board of Education. It has been suggested that they are bad because they encourage mothers to work away from home, but there are a certain number of women obliged to work in laundries, factories, etc., and then children run risks if there is no place available in which they can be looked after. About 98 exist at present, and more are wanted. They should be associated with other bodies undertaking infant welfare work, e.g. School for Mothers, and with the Medical Officer of Health and the School Medical Officer. The Board of Education quite realises that the best training of children from three to five is in a good home. It is the lack of the good home which creates the need for nurseries and nursery schools.

2. **Nursery Schools.** These mostly deal with children of ages two to five. They were first founded by voluntary effort and are intended to act as a link between the home or day nursery and the elementary school and are usually organised in accordance with the recommendations of the Board of Education. They differ from the crèche in that they aim at *training* the child, chiefly in personal habits and conduct, in developing brain, muscles, senses, and beginnings of self-control and discipline, and so laying the foundations for character-formation. Mr. Fisher obtained power in 1918 to found more of these schools for children under five and over two. In 1930 there were forty-four nursery schools, accommodating about 3000 children (twenty-three under Local Authorities and twenty-one voluntary).

The Board of Education considers that the essentials of a nursery school are light, air, sun, easy exits, ample playgrounds, good offices, sufficient bathing arrangements. The curriculum should encourage games and free-play in the open air, cleanly habits, kindly discipline, short organised lessons, excluding formal lessons in reading, writing, etc. There should be plenty of rest and sleep, preferably in the open air.

The Board deprecates the idea that any teacher is good enough, and holds that the care of these young children presents difficulties at least equal to those in teaching older children. A specially trained nurse is needed, and great importance should be attached to prompt exclusion of children showing signs of infectious disease, and not too much effort made to secure regular attendance.

The need for such schools is fully recognised in France, Belgium, etc.

Miss M. McMillan, who was a pioneer in urging the need of these schools and in herself establishing one in Deptford, held that the school must be large, accommodating one hundred or more children, and these should include children of seven who would help the little toddler by their experience, as in a family. The staff must also be large and the children should be divided into small groups of not more than six to each nurse-teacher. The school should also be a training college for nurse-teachers who should give half the day to their own studies. There should be a real English child's garden, and architects should solve the climate difficulty and provide for open-air classes. The child brought up in such a school would, according to Miss McMillan, bear no resemblance to the ordinary child, for it would be clean, intelligent, speaking and reading English, master of the three R's, and so ready for an education which would be the prelude to a much higher secondary education than is yet dreamed of. Probationers in nursery schools should be offered every educational advantage, including voice-training, drawing, history, literature, and handwork as far as would provide successful teaching up to fourteen.

Miss McMillan believed that this need not mean any violent dislocation of infant school work, because we should proceed by compromise. Many existing infant schools would be adapted for nursery schools.

3. **Schools for Mothers.** Dr. Fraser, M.O.H. for Chesterfield, says, " Poverty with its accompanying conditions of overcrowding, neglect, etc., has a great influence on infant mortality, but given a good 'educated' mother a child can be successfully reared amidst very poor surroundings, e.g. Dr. Eric Pritchard relates that in a recent mothercraft exhibition in London, the woman who gained the second prize was a poor mother who was successfully bringing up three children on an allowance of 11s. 6d. weekly." The Siege of Paris is often quoted as an example, because in spite of the misery and starvation the infant death-rate actually fell because of the increase of breast-feeding.

The School for Mothers is primarily *educational,* providin training and instruction for the mother in the care an management of little children. This is done in three ways (*a*) Classes, (*b*) home-visiting, (*c*) infant consultations. Th provision of *treatment* if any should be only incidental. Th work carried out by the schools necessarily overlaps the wor of Maternity Centres to some extent, but the distinction lie in the main object of the school being *education,* whilst tha of the Centre is health *treatment.* The School for Mother can be comparatively simple and informal. Mothers com because they are made welcome, because their pride in thei babies is stimulated, and because they grow to realise th value of the teaching. Hence the need of a friendly relatio between mothers and workers.

The Infant Consultations should be in charge of a doctor though in rural districts a nurse, acting under a doctor, ca do weighing and give advice. *Home-visiting* is most effectiv when in charge of a paid superintendent or nurse, with suc paid or voluntary help as is necessary. *Classes* usuall begin with " health talks " on simple everyday subjects, t the women attending the consultations. Sewing-classes ar organised, and by degrees a series of classes on differen subjects, e.g. cookery. Always the instruction should b simple, and as much practical demonstration and work a possible should be introduced. The women themselve should be consulted about drawing up lessons. These school are specially adapted for teaching *household thrift*—so necessary now—also for explaining the advantages of medica inspection, which are not, as a rule, understood, and th importance of such things as decayed teeth, malnutrition rheumatism, mouth-breathing, adenoids, defective sight, ho to nurse measles and whooping cough, etc. Also this is on of the places where simple teaching in *sex hygiene* and th training of adolescent boys and girls can suitably be give to the mother. Much can be introduced incidentally, an occasionally a separate lesson can be given. In other case personal talks or talks to small groups are given. One hundred and eighty-three schools for mothers received Grant in 1915.

The following outline of the Chesterfield Infant Welfare Scheme illustrates the kind of work which can be done.

(1) Two health visitors visit notified births. The visits of the nurse are now welcomed and occasionally a request for a visit is sent to the Health Office. (2) An Infant Welfare Sub-Committee has been appointed with co-opted lady members, who also act as managers of the ward clinics. (3) Four baby clinics exist, one for each of the four wards of the town. They are really mothercraft schools. They meet weekly and the health visitor weighs babies and advises on all matters of infant hygiene. Dried milk is sold—over £200 worth in 1916. It gives excellent results, does not tend to rickets, and is very safe in the hot months, because it is so much less liable to contamination. Also it is economical and easy to prepare. In some places, however, it has been found difficult to get mothers to mix the milk properly, even though the directions on the tins are simple, and so modified cow's milk is more used. A drawback to dried milk arises from the fact that there are several brands, of much the same composition, but the milk differs when mixed, owing to some differences in preparation of the powder. Also "health talks," "savings clubs," "exhibition of thrift—garments," "demonstrations in hygienic methods of feeding," etc., are given at the clinics. Mothers are asked to bring all children under five years old. Many voluntary helpers are employed at the clinic, but *not* for home-visiting, this being done by trained workers. (4) A Banana-Crate Cradle Centre, managed by the Women's Adult School, supplies these cradles fully equipped at from 4s. to 5s. each. Thirty-eight were sold in 1915. The aim is to stop babies sleeping in the same bed as the mother, and at the same time to provide a healthy form of cradle. (5) The baby clinics do not provide medical treatment, and hence a Central Treatment Centre was started in 1915. The Medical Officer of Health acts as doctor to this Centre, and attends daily in July, August and September, and twice a week for the rest of the year. The health visitors attend similarly. The equipment includes consulting-room, kitchen, waiting-room and weighing and treatment room, containing three beds so that a child can be put to bed there for a day

No cases, however, are kept overnight. The chief ailments dealt with are summer diarrhœa, digestive troubles, rickets and ophthalmia neonatorum.

Importance of teaching Mothercraft to Elder Girls and Young Women. *Method in Schools.* (See *Education and Infant Welfare*, Circular 940 of the Board of Education.) "The experience of Schools for Mothers shows that many women have had no instruction at all in infant care before their children were born, and that they have been dependent for advice on family traditions and on hints given by neighbours and relatives. It is certain that infant mortality and suffering would be much reduced if all women could have some training in the management of infants before or soon after marriage. If such apparently simple matters as the proper way to clothe, feed and care for a baby were known, they would be able to keep their babies in much better health and would be more ready to seek advice on the appearance of early signs of illness." The only time at which one has the chance of giving the majority of girls this instruction is during school life. The teaching should, of course, come as near the *end* of school life as possible, and should be carried further at Continuation Classes, and though the attendance at such classes has been hitherto optional, it is compulsory up to sixteen under the 1918 Education Act. Hence of late years the Board of Education has advocated the teaching of mothercraft to girls in school. If it be argued that this is too early an age at which to begin, one must remember how much girls of twelve to fourteen have to do in their own homes, in the way of looking after the younger children in the family, and the methods taught in school may be applied at home immediately, and, further, may teach the parents to do better. In this connection, one wants to enlist the sympathy of the mothers as much as possible, for if they only jeer at the school teaching, they undermine its effect on the children. It is a good idea for the teacher to have occasional "Mothers' Meetings" and discuss the lessons given to the girls, for one can teach the mothers a good deal thus. Also, one may get the school Medical Officer or school nurse to do this. Another argument in favour of the teaching is the interest which the girls take in it. The lessons are always popular, probably because (1) they appeal to the girl's natural instinct for motherhood. (2) They are within the scope of her practical experience and home life.

Matter. One should aim at training the girls practically in details of the ordinary nursery care of a baby, i.e. how to dress, wash and feed it, how to train it early to clean habits, its special need for warmth, air, sun, cleanliness. The danger of unsuitable food or methods of feeding, of dirt in any form, of insufficient or too many clothes, of cold or chill, of lack of or disturbed sleep, of lack of air and exercise, etc., should be clearly pointed out. The girls should also learn the signs of indigestion (e.g. sickness, diarrhœa, constipation, wasting), how to make a cradle, why a comforter is bad, etc.

Method must be as *practical* as possible. Some theory must be taught, and it is best for the teacher to explain this and let the girls take notes, rather than rely on a " reader " or textbook. The greater part of every lesson, however, should be practical. And here arises the question as to what to practise on—baby or doll ? Now, the real baby has a good many superiorities to the doll, e.g. it is much more difficult to handle, being infinitely more slippery for instance ; it is more interesting to make up a " bottle " for a baby who will drink it than for a doll which won't. On the other hand, one cannot give a baby more than one bottle at a time, and one cannot dress and undress and wash it an unlimited number of times—as one can a doll ; also mothers are chary of loaning out babies. Hence one must mostly do with a doll, but a baby can be got in occasionally. The doll must be a real " model " of a baby (e.g. Arnold's 10s. 6d.).

Clothes. These should be made in school by the girls in needlework lessons, and should be hygienic and as simple and cheap as possible.

Apparatus. The cradle should be also made in school from a banana crate (1s.) with mattress and pillow of chaff, and blankets cut from old ones. Other articles can mostly be brought by the girls from home, on the day of the lesson, e.g. towel-horse, bath, towels, brush. The lessons should be *repeated* till every girl has actually washed, dressed and made up feeds for the baby. In this connection it is interesting to find that girls who are dull and backward in ordinary work will often respond to this baby-work quite as well as the rest, and they often improve in other work as a result of the stimulus that success brings.

Qualifications of Teacher. Usually it is best if this work is done by a member of the regular staff and not by an outsider, because a member of the staff knows the girls in a way that no outsider can, e.g. she knows parents, home circumstances, etc. Also she can link up the work with the rest of the school curriculum. These points are probably of even more importance than knowledge of technicalities, in which the visiting teacher may be her superior. Again, it is difficult with a visiting teacher to get the lessons *repeated* often enough to give every girl a chance of practising what is taught.

Place of the lesson. If the teaching is to be given to all the girls and if the lessons are to be frequent, practically the school is the only possible place for them. The accommodation at cookery and laundry and housewifery centres is usually insufficient for this in addition to the ordinary domestic classes held there. It is, however, quite good to *supplement* the work in school with more at a day nursery (crèche), but if it is done exclusively at the latter, all the objections already mentioned come in, i.e. it drops out of the hands of the ordinary staff and the crèche staff is often too busy to *teach* girls sufficiently. The crèche, however, gives the girls the chance of handling the real article, and so it would be a good thing to let a course at the crèche follow the teaching in school. In a number of nurseries (e.g. Acton, Hanwell, Leeds, Plymouth), classes in infant management are held for girls from neighbouring schools and the teaching seems to yield good results. For this to be done, the nursery needs adequate accommodation and equipment, and the matron should be able to give the teaching. Schools for mothers can be utilised to a less extent, as at Swansea and a few other places. Another possibility would be to provide a day nursery at some of the Domestic Training Centres, and this would have advantages over the separate crèche in that it would link up the baby-work with the cookery, housewifery and laundry work.

Continuation Classes. It is exceedingly desirable that these should exist, because the girls in the elementary schools are too young to grasp fully the meaning and responsibilities of motherhood, and the teaching in the school must therefore only be very simple and incomplete. Again, girls often go straight from school to factory, and straight from factory to marriage, and so some years elapse before they get a chance of practising what the school taught, and in the meantime they forget some, at least, of it. Continuation classes might well be held in connection with day nurseries, schools for mothers, etc., and in them one can take the subject more fully and completely, e.g. including common illnesses and care of the *mother's* health during pregnancy and whilst she is feeding the child, and the effects on the child of her health.

A Course of Hygiene (suggested by Dr. Janet Campbell, in Circular 758, Board of Education, 1910).

(*a*) Girls between seven and twelve. (i) *Personal hygiene,* including simple lessons in neatness, cleanliness, attention to hair, nails, teeth, etc. (ii) *Fresh air and ventilation:* Need of fresh air; ventilation of room; need for open windows at night as well as day; effects of stuffy rooms; value of sun. (iii) *Warmth.* Why people, and little children especially, must be kept warm and free from chills. How to lay a fire; the fire as a ventilator; fire-guards; clothing. (iv) *Cleanliness.* Necessity to health; clean body, food (especially water and milk), clothes, home. (v) *Eating and drinking.* Why food is necessary; what kinds are good and necessary and what unsuitable; value of milk, specially for babies and children. Table manners. How to lay a table. (vi) *Clothing.* Best kind to wear; best materials for underclothes; danger of flannelette; how to keep clothes clean and mended. (vii) *Sleep.* Why needful. Why little children should go to bed early; how to make a bed, air it and keep it clean.

(*b*) *Girls of twelve to fourteen.* A continuation of the above with more completeness. *Also* (i) *housekeeping.* How to spend the weekly income to the best advantage; marketing; how to make the home comfortable, pretty; thrift, etc. (ii) Temperance—based on the Board's Syllabus. (iii) Simple home nursing, e.g. how to make a sick person comfortable, how to attend to simple ailments and injuries, how to make a poultice; infection and disinfection. (iv) *Personal hygiene and the elements of health of a community* including sanitation of the home, removal of refuse, personal health, prevention of tuberculosis. (v) *Care of* infants and young children.

In connection with *b* (iv) in the above course, one must remember that the large number of deaths from diarrhœa and enteritis are partly due to a group of factors which can be dealt with by the Sanitary Authority. For example, in towns where an out-of-date conservancy system of sanitation or a pail-closet system is used, infant mortality is excessive and, conversely, the lowest death-rate from diarrhœa occurs where the water-carriage system is used. In several towns the conversion of a conservancy to a water-carriage system has greatly reduced deaths from diarrhœa. The importance of municipal cleanliness in street-washing, supply of baths, frequent emptying of ash-bins and removal of stable manure (in which flies breed), etc., is enormous. Inadequate water-supply, choked closets and drains, filthy courts and alleys, absence of proper facilities for storing food, etc., all mean higher death-rate of babies, since all mean greater liability to contamination of food, especially milk, by germs, often fly-borne.

CHAPTER XXIX

LEGISLATION AFFECTING SCHOOL CHILDREN

The Factory Act, Children Act, Education (Provision of Meals) Acts, Medical Inspection and Treatment, Blind and Deaf Act, Defective and Epileptic Acts, Mental Deficiency Act (1913), Employment of Children Act, Education (Choice of Employment) Act—Need for careful supervision of juvenile employment out of school hours.

1. **The Factory Act.** Owing to the new Education Bill, which was read for the third time on 16 July, 1918, so practically becoming law, the need to consider the Factory Act here is considerably lessened, since the Education Bill makes "half time" employment impossible. Until now, it has been possible for a child to enter a factory as a half-time worker at twelve years old and to continue coming to school either for half of each day or for alternate weeks, till the age of thirteen or fourteen, according as he obtained a certificate of proficiency in the three R's at thirteen or not. About 35,000 children are thus employed. Under the new Bill, however, every child *must* stay at school till fourteen and from fourteen to sixteen must put in 280 hours' instruction per annum in a continuation school. Seven years from the day on which the Bill comes into force, the age-limit will become eighteen instead of sixteen and the number of hours 320 instead of 280.

The half-time system was practically restricted to the cotton factories of Lancashire, and it was from this quarter that the opposition to the change came. The old regulations for half-timers are already beginning to have a slightly antiquated air, but it may be of interest to very briefly recapitulate the more important of them.

Fitness for Employment. (1) No child less than twelve years old can be employed. (2) No child must be employed for more than seven, or if the certifying surgeon lives more than three miles from the factory, for more than thirteen days without the employer getting a certificate of fitness. (3) *A certificate of fitness* is granted by the certifying surgeon for the district, who must examine the child at the factory (unless less than five are employed) and be satisfied by the production of the birth-certificate, or other evidence as to the child's age, and must see that the child is not incapable owing to disease or infirmity. The certificate may be qualified by conditions as to the work the child is fit for. The surgeon can examine any process in which the child is to be employed, and can demand that any child who *is* employed, but is unfit, shall stop work until re-examined and found fit.

This certificate is required by any worker *under sixteen*, the idea being to so supervise the health of adolescents up to this age, but in practice it often fails, because the factory surgeon does his work perfunctorily. He is usually a private doctor and he is paid by the employer and not by the State. It would be much better if he were on the staff of the school doctor, who already knows the medical history of the child.

Education of Children. The parent must send the child to school for either half of each day, if the child be employed in the morning or afternoon, or on alternate days, if employed on alternate days. The child must not attend school on Saturdays or in school or factory holidays. If the child has not made all his school-attendances in a week, he must not be employed in the next week till he has made up the deficit of school-attendances. The employer must get a certificate of school-attendances weekly from the teacher. At thirteen, if the child has a certificate of proficiency in reading, writing and arithmetic, he can be considered a "young person."

Dangerous and Unhealthy Industries. No child can be employed in wet-spinning unless sufficient means exist to prevent wetting and escape of steam into the room. No child can be employed where mirrors are silvered by the mercury process, *or* where white lead is made, *or* where glass is melted or annealed, *or* where bricks or tiles are made or finished (except ornamental tiles), *or* where salt is made or finished, *or* where dry grinding in the metal trade is carried on, *or* where lucifer matches are dipped.

No child may have a meal or stay during meal-times in the following factories and workshops: (*a*) The part of a *glass works* where materials are mixed, or flint glass is ground, cut or polished. (*b*) Where *lucifer matches* are made (except cutting the wood). (*c*) In the dipper's house, drying-room or china scouring-room in *earthenware works*.

Legal Proceedings. If a child be employed contrary to the provisions of this Act, the parent is liable to a fine of not more than £1 for each offence. If the parent does not send the child to school, he is liable to £1 fine for each offence.

2. **Children Act, 1908.** This Act deals with (A) The protection of Infant Life; (B) Prevention of Cruelty to Children; (C) Juvenile Smoking; (D) Reformatory and Industrial Schools; (E) Juvenile Offenders; (F) Penalties on giving intoxicating liquor to Children and for admitting them to public-houses; (G) Cleansing of Verminous Children.

(A) The section on Infant Life is outside the scope of our work.

(B) That on *Prevention of Cruelty* to Children states that any person who wilfully neglects a child in a way likely to cause unnecessary suffering or injury to health (a) is liable to a fine of not more than £100, or in default, or in addition, imprisonment with or without hard labour for not more than two years. (b) On summary conviction a person is liable to a fine of not more than £25, or in default, or in addition, imprisonment with or without hard labour for a term of not more than six months. (c) Failure to provide adequate food, clothes, medical aid or lodgng, or if unable to, to take steps to get the same as poor-relief, counts as neglect. (d) The court may, if it think it necessary, take a child from the custody of a parent convicted of offence against the child and commit it to the care of a relative, or other fit person, till sixteen years old, or for a shorter period, and may make the parent pay for its maintenance up to £1 weekly.

(C) The section on *Juvenile Smoking* forbids the sale of cigarettes or cigarette papers to persons apparently under sixteen, empowers police and park-keepers to seize cigarettes in possession of a person apparently under sixteen if smoking in the street or a public place. This also applies to tobacco other than cigarettes, except that one may sell it to a person under sixteen, if one does not know and has no reason to believe that it is for his own use.

(D) **Reformatory and Industrial Schools.** A Reformatory School means one for industrial training of young offenders, in which they are also fed, clothed and lodged. An Industrial School means the same, but the children need not be "offenders," and they can be "boarded out," with the consent of the Secretary of State.

Method of sending children to such Schools. If the offender is between twelve and sixteen and is convicted of offence which in the case of an adult would be punished with imprisonment, the court may, in addition to or instead of other punishment, send him to a Reformatory. A child can be sent to an Industrial School, if under fourteen and begging *or* wandering without visible means of support, *or* destitute while parents are in prison, *or* if parents are drunken or criminal, *or* if the child be in company with a reported thief or prostitute (except the mother), *or* if a child apparently twelve or thirteen be convicted for the first time of an offence punishable in the case of an adult with imprisonment, and if the Court be sure that he will not exercise an evil influence on other children, *or* if the parents prove that they are unable to control the child and want him sent to the school.

Persons who may take proceedings to get a child into an Industrial School include police, Local Education Authority and parents. *Choice of School.* A child can be sent to any certified school whose managers consent.

Period of detention. (a) Reformatory three to five years, to age of nineteen. (b) Industrial. Any time, up to sixteen. *Supervision after leaving.* (a) *Reformatory.* If let out before nineteen a scholar remains under the supervision of the managers of the school till nineteen. (b) *Industrial.* A scholar remains under the supervision of the managers of the school up to eighteen.

Expenses of certified schools are met partly by Government grants, partly by the Local Education Authority of the district from which the children come, and partly by parents, if able to pay.

Day industrial schools may be certified if the Secretary of State be satisfied that they are needed.

(F) **Penalty on giving intoxicants to Children.** Anyone who gives alcohol to children under five, except on doctor's orders, or in case of illness, is liable to a fine of not more than £3. No child is allowed in bars. Offenders are liable to a fine up to £2 for the first offence and £5 for subsequent offences.

(G) **Cleansing of Verminous Children.** A Local Education Authority may direct their Medical Officer, or any person to whom he gives authority, to examine any child in any elementary school, and if it is verminous or filthy the authority may give written notice to the parent to cleanse the child in twenty-four hours. If the parent fails to do so, the Medical Officer or someone to whom he gives authority may remove the child from school and have it cleansed in suitable premises. If the Sanitary Authority has suitable premises for cleansing, it must let the Education Authority use them, on payment. If the parent again lets the child get verminous he is liable to a fine up to 10s. The Education Authority must give the parent written directions for cleansing. The examination and cleansing of girls may only be done by the doctor or by a woman.

3. **Education (Provision of Meals) Act, 1906.** Empowers a Local Education Authority to take steps to provide meals for children and to associate themselves with any committee on which the Authority is represented which will undertake to provide food for children, and to aid that committee by furnishing land, buildings, furniture and such officers and servants as may be needed for organisation, preparation and service of meals, but the Authority must not incur expense in buying food except under the two following conditions: (1) The parent is unable to pay and not by his own fault. Otherwise the parent is to be charged for the meal and the Education Authority can recover the amount as a civil debt. (2) If a child be unable to profit by education because of lack of food, and no funds except public ones be available, the Education Authority may apply to the Board to spend money out of the rates on food, to the extent of ½d. in £1 of rates. The Act stipulates that no teacher shall be required as part

of his duties to supervise or assist, or to abstain from supervising or assisting in the provision of meals or the collection of the cost thereof. *The Provision of Meals Act of* 1914, passed a few days after war began, repealed this halfpenny limit, and legalised the provision of meals during holidays and other days when the school is shut. In June, 1914, the Provision of Meals *Regulations* providing grants in aid were issued and admit of fifty per cent of the net cost being supplied. In distributing the grant the Board takes into consideration (*a*) the extent to which the work is co-ordinated with the school medical service. (*b*) Care in selecting the children. (*c*) Sufficiency and suitability of dietary. (*d*) The extent to which attention is given to the *educational* aspect of the work. (*e*) Suitability of accommodation and equipment and efficiency of service and supervision of meals. (*f*) Completeness of arrangements for ascertaining the effect of meals on the physical and mental state of the children.

4. **Medical Inspection and Treatment** was introduced in 1907 by the Education Act (Administrative Provisions), which stated that a Local Education Authority *must* provide for medical inspection immediately before, or at time of, or as soon after entrance to school as possible, and on such other occasions as the Board of Education direct. Also that it *may* make such arrangements as the Board of Education sanction for attending to health and physical condition of the children. However, the new Education Bill (1918) makes treatment compulsory.

5. **Elementary Education (Blind and Deaf Children) Act, 1893.** This Act stipulates (1) that a parent must see that the child gets elementary education. (2) Every school Authority *must* enable blind and deaf children in their district to get elementary education in a certified school and must therefore establish such a school or contribute to one, and if necessary arrange for boarding out children in a home near the school. (3) Parents are liable to contribute to the support of the children. (4) Education is compulsory till sixteen.

6. **Elementary Education (Defective and Epileptic Children) Act, 1899,** states (1) that the school Authority *may* with the approval of the Education Department make

such arrangements as they think fit for ascertaining (*a*) what children in their district, not imbecile and not merely dull and backward, are defective, i.e. by reason of mental or physical defect are incapable of receiving proper benefit from instruction in the ordinary elementary school, but are not incapable of benefit from instruction in special classes or schools. (*b*) What children are epileptic, and unfit by reason of severe epilepsy, to attend the ordinary elementary school. (2) The school Authority in making their arrangements shall provide facilities for parents to present such children to the school Authority to be examined, though they may not have been required to do so. (3) A doctor's certificate is needed to say that the child is defective or epileptic. (4) The Education Authority may provide for defective children by any of the following means: (*a*) Special classes in public elementary school. (*b*) Boarding out children near a special class or school. (*c*) Establishing a school for defectives. (5) The Education Authority may provide for epileptics by establishing special schools. (6) The school Authority may contribute to the support of schools in other districts attended by children whose permanent homes are in their district. (7) The parent *must* send the child, if more than seven years old, to the special class or school, if within reach. In the case of an epileptic child more than seven years old, the school Authority may apply to a Court of Law for an order requiring the child to be sent to a school for epileptics. (8) Parents are liable to contribute to the cost of maintenance. (9) Education is compulsory till sixteen.

In connection with the above Act, we must consider two later ones:

(1) **The Elementary Education (Defective and Epileptic Children) Act, 1914.** This makes it the *duty* of the Local Education Authority to provide for children more than seven years old who are mentally defective. They need not provide board and lodging unless suitable provision cannot be made in any other way. The Local Authority shall try to ascertain and as far as possible give effect to parents' wishes, but if satisfied that the parent is not making suitable provision for the education of a defective or epileptic child, it can require

him to send the child to a certified school or class. The Authority cannot send a child to a class or school out of reach of the child's residence, or to a boarding school, without the written consent of the parent, unless it can be proved that consent is unreasonably withheld. The 1918 Education Bill, just passed by the Commons, extends the benefits of this Act to *physically* defective children.

(2) **The Mental Deficiency Act of 1913,** which *compels* the Local Education Authority to notify all defective children more than seven years old (*a*) who are incapable of receiving benefit in a special school or class, or whom the Board of Education certify need supervision or guardianship, and (*b*) who at or before sixteen are about to be withdrawn or discharged from a special school or class and whom the Local Education Authority consider should be sent to an Institution or put under guardianship. Further, if a person be sent to an Institution for Defectives he can be detained for life, if it be considered necessary. Also he, or the persons liable to maintain him, may be called on to contribute to the cost of his support. *Duties of Local Authorities.* The County or Borough Council is the Local Authority for this Act. It must ascertain how many defectives need to be dealt with and must provide supervision for them. The Local Education Authority, however, must, as above stated, ascertain the number of defective children (seven to sixteen), how many are incapable of benefit in special classes of school, and must notify names and addresses to the Local Authority.

7. **Employment of Children.** All employed children come under the protection of Section III of the *Employment of Children Act*, 1903. This Act empowers any Local Authority to make by-laws prescribing (1) the age below which employment is illegal. (2) The hours between which employment is illegal. (3) Occupation in which employment is illegal. It can also regulate street-trading under sixteen. *Section III.* (*a*) A child shall not be employed between 9 p.m. and 6 a.m., but the Local Authority may vary these hours either generally or for specified occupations. Clause 13 of the new Education Bill introduces an amendment to this forbidding the employment of any child under the age

of twelve, and stating that children over twelve must not be employed on school days before the close of school hours, nor on any day before 6 a.m. or after 8 p.m. A Local Authority may make a by-law allowing employment of children in certain specified occupations and under specified conditions, but even here the employment may not last for more than one hour before 9 a.m. on a school day, and a child so employed may not be employed for more than one hour in the afternoon. (*b*) A child under eleven shall not be employed in street trading. The 1918 Education Act repeals the age-limit of eleven, and hence no child under fourteen may now engage in street trading. (*c*) No child employed half-time under the Factory Act shall be employed in any other occupation. This stipulation now becomes unnecessary, since half-time is abolished. (*d*) A child shall not be employed to lift or carry or move anything so heavy as to be likely to injure him or her. (*e*) A child shall not be employed in any work likely to be injurious to life, limb, health or education, regard being had to his physical condition. N.B.—Here " child " means under fourteen.

Children have hitherto been allowed to leave school before fourteen, under certain conditions set out by the Elementary Education Act, 1893 (School Attendance) and the Amendment Act, 1899, for Agricultural Employment ; and for other forms of employment, if they satisfy the conditions of the local by-laws. During the war the restrictions were relaxed a good deal in agricultural districts, and a good many children availed themselves of the chance of leaving school early under the by-laws, who in ordinary times would stay longer ; e.g. from September, 1914, to January, 1915, 1,538 boys and 53 girls between eleven and fourteen, who were normally liable to attend school were excused : 1,388 boys and 25 girls for agriculture, 30 boys and 1 girl for factories ; 120 boys and 27 girls for other employments. The Board of Education considers that some Local Education Authorities granted exemptions too easily and without careful enough ascertainment that the conditions prescribed by Government were fulfilled. The extent of juvenile employment increased as the war proceeded ; thus in 1916 about 45,000 children in excess of the normal number left school for employment, excluding half-timers and those specially exempted. The

last group contained 15,000 special exemptions for agricultu
alone, on 31st May, 1916. The Board states that the ear
withdrawal from school arrest education just when t
child is beginning to assimilate and consolidate the instructi
received and puts him under strain which is harmful physicall

8. **The Education (Choice of Employment) Act, 191**
was passed to enable a Local Education Authority to give bo
and girls advice, information and assistance with respect
choice of employment. It states that a Local Educati
Authority can arrange to give boys and girls under sevente
assistance with regard to choice of suitable employment
means of collection and communication of information a
the furnishing of advice. The new Education Bill exten
the age to eighteen. The school doctor should supply t
Juvenile Employment Department of the Education Co
mittee with any information he has about children w
need special consideration in the choice of work, owing
physical defect.

Employment of Children out of School hours. There
great need for supervision of the conditions of such emplo
ment. Excessive hours of labour are found to be oft
associated with conditions of mental and physical strai
and it is obvious that children so employed are incapable
attention during school hours. Even in normal times t
evil is serious, and it has been increased by the war. T
Board of Education urges the Authorities concerned to atte
to the matter and points out six chief evils needing remed
(1) Interference with sleep, school and regularity of mea
(2) The employment is often unfavourable to health a
growth. (3) The employment is generally unskilled and u
educative, and the boy tends to become an untrained a
unemployable man. (4) The frequency with which the b
changes his job tends to instability. (5) The work oft
brings the boy into undesirable surroundings. (6) Insufficie
medical inspection and supervision of children. All su
children might be examined as "specials," for the discove
of defects would often reveal harmful conditions of emplo
ment and would probably result in many cases in the resc
of the children from serious harm

Recognition of the truth of these facts has, by 1923, led 305 of the 317 Local Education Authorities to make by-laws regulating the employment of school-children, and many school medical officers now examine children to ascertain their fitness for employment out of school-hours.

CHAPTER XXX

EUGENICS

EUGENICS is defined in the minutes of the University o London as "The study of agencies under Social Control tha may improve or impair the racial qualities of future generations, either physically or mentally."

The word "eugenic" is comparatively new, having bee invented only in 1884 by Sir Francis Galton, who first use it in his book on Human Faculty. There he explains that i is derived from the Greek "eugenes," which means "good i stock; hereditarily endowed with noble qualities," and h goes on to say that "we greatly want a brief word to expres the science of improving stock, which is by no means confine to questions of judicious mating, but which, especially in th case of man, takes cognisance of all influences that tend, i however remote a degree, to give to the more suitable race or strains of blood a better chance of prevailing speedily ove the less suitable than they otherwise would have had." Th word eugenics would sufficiently express this idea.

Returning to Galton's definition of eugenics as "the stud of agencies under Social Control that may affect racia qualities," one naturally asks next, What *are* the agencie that affect racial qualities, and which of them can be considered as "under social control"? And the answer to th first of these questions is that the agencies fall into two larg groups. The first group contains all the agencies dependin on *Inheritance or Heredity*; i.e. the characters and tendencies whether of body or mind, that are handed down from paren to child. The second group contains all the agencies dependin on *Environment*; i.e. the surroundings in which the rac exists, including such things as food, climate, education, th presence of disease-germs, etc. The Report of the Nationa

Birth-Rate Commission, 1917, says, "Human life, in itself, under healthy conditions, may be assumed to be desirable and valuable. The degree of its value will depend on its inborn character and its environment."

Whether sixty years ago one could have expected people to agree to this classification is doubtful, for Galton, speaking of 1859, the year in which Darwin published his *Origin of Species*, says that the current views on heredity were so vague and contradictory that it was very difficult to state them. Generally, most authors agreed that all bodily and some mental qualities were inherited by the lower animals, but they refused to believe the same of man, and altogether opinion was very vague, and the subject of human heredity was never squarely faced. Even the word "heredity" was considered fanciful and unusual, and Galton was chaffed by a learned friend for adopting it from the French.

However, misty as may have been the ideas of that day on the subject of heredity, still the idea was there, embodied in proverbs such as "Like begets like"; "Like father, like son," and so on. To-day it may be said that the subject of human heredity *has* been and is being squarely faced, even though its problems are still only beginning to be solved. And that facing of the problems has been largely brought about by two things: first, the advances made in the science of biology and initiated by Darwin's work, and second, a fairly widespread feeling amongst the people who think at all about such matters that things were not going quite as well as they might in matters of social reform, and a consequent attempt to reconsider the faiths on which our social legislation and philanthropy were based.

That attempt led some people to the conclusion that there were *two* factors to be reckoned with in all schemes for bettering social conditions, viz. the factors of *seed and soil*, and that hitherto we had denied the existence of one of these, in deed if not in word, and that the rather unsatisfying results of the great expenditure of time, energy and money which has been going on ever since the ideas of social reform began to be put into practice in England, i.e. for about the last hundred years, might be due to this ignoring of one of the two factors, viz. the seed, and to the concentration of all thought, effort and money on the other, viz. the soil. There is no doubt that our modern social legislation and philanthropy *have*, up to a few years ago, entirely concentrated on the improvement of the soil, or environment, and that we have assumed that thus we should benefit not only the individual but also the race. We have further assumed that this was the only channel along which help could come to the race.

As Mr. Havelock Ellis puts it, our reforms have proceeded in four stages :

1. The effort to clear away the gross filth of our cities, to improve dwellings, to introduce sanitation and to combat disease.

2. The attempt to regulate the conditions of work, as exemplified in factory legislation.

3. The still more fundamental step of taking the *children* in hand, providing national education, medical inspection and treatment, free meals, etc., this stage culminating in the last few years in the development of Infant Care, Schools for Mothers, Infant Consultations, Maternity Centres, etc., i.e. the public supervision of the child from the moment of its birth onwards to adolescence.

4. The most fundamental step of all, i.e. the attempt, which is just beginning, to provide the conditions of healthy life for the child even *before* birth, by looking after the mother's health for some months before the child is born.

Now, these improvements in environment have absolutely transformed the conditions of life. We should be horrified to-day if we found anyone living under the conditions which were usual during the first half of the nineteenth century. As an example of those conditions take the report on the condition of Bethnal Green, published in 1848 by Hector Gavin, under the title *Sanitary Rambles*. Bethnal Green, owing to industrial expansion, had just become a town. There were thirty-three miles of street in it and a hundred miles of by-ways, not including courts and alleys, but only a few miles had sewers. Dust-bins were unknown, as were all other forms of sanitary convenience ; slops and all other refuse were thrown out of windows or doors into the street, where the solid parts of the refuse collected in mountainous, evil-smelling heaps, which was not surprising since the scavengers were "thirteen decrepit old men," and it took them ninety days to get once round the parish. Hence disease and epidemics were rife. And this was typical of many places. The people were reckless, improvident, intemperate, multiplying as carelessly as rabbits, though babies died at such a rate that the increase of population was not excessive. Under these conditions the race remained vigorous, and English workmen were noted for what was called their "savage industry," surpassing that of any other people. Even in France and Germany it paid to import English navvies and pay them double wages, on account of their superior energy.

As a second example illustrating how greatly we have improved environment, take the death-rate of London. Two hundred years ago it was 8 per cent. In 1909 it was 1·5 per cent.

As a result of this improved environment one *might* expect considerable racial improvement, but there seems no reason for believing that the quality of the population is any better than when most of it lived in filth, drank to an extent unknown nowadays, and was decimated by disease. For instance, one test of the success of social reform is the amount of *pauperism* existing. In 1909, the Royal Commissioners on the Poor Law wrote as follows : " Notwithstanding our assumed moral and material progress, and notwithstanding the enormous annual expenditure amounting to nearly £60,000,000 a year on poor-relief, education and public health, we still have a vast army of persons quartered upon us unable to support themselves ; an army which in numbers has really shown signs of increase rather than decrease. To what is the retrogression due ? It cannot be attributed to lack of expenditure. Is this costly and elaborate machinery we have established defective, and if so, where does it fail to accomplish its end ? Is the material upon which this machinery operates becoming less amenable to the remedies applied ? . . .

The statistical review of the expenditure incurred and of the results attained by it prove that something in our social organisation is seriously wrong, and that, whatever may be the evils, they are not of such a nature as can be improved or removed by the mere signing of cheques or the outpouring of public funds."

Again, in reporting on able-bodied pauperism, the Commission says, "The consideration of these statistics leads to the conclusion that it is in regard to the able-bodied that least progress has been made. Indeed it would appear that there has recently been a considerable retrogression in this branch of the Poor Law. Either the urban population is becoming less fitted for maintaining their independence, or the facility with which relief may be obtained and the immunity from labour which it confers are enticing a larger number of persons to avail themselves of the Poor Law relief."

The Commissioners also stated that in a recent year, between 30,000 and 40,000 able-bodied men in health received outdoor relief without any task or work.

These remarks apply to official pauperdom only, but in addition to the paupers relieved by the State there is a large class supported unofficially by private philanthropy and charity, and this number is impossible to calculate, but if one remembers the great increase of hospitals, homes, charitable societies, etc., it is almost certain that there has been an increase in the proportion of people who cannot or will not support themselves.

The *causes* of pauperism are various, including economic conditions, ill-health, lack of "grit," mental and moral defect. With regard to these causes, it is, I believe, a fact that economic conditions such as lack of employment, wages and cost of living have not become worse in recent years (apart, of course, from war conditions), but that they are better on the whole than thirty years ago, and therefore the increase of pauperism is probably not chiefly due to economic conditions. Dr. Tredgold, the medical expert to the Royal Commission on the Feeble-Minded, ascribes it to either physical or mental incapacity. He considers that the number of the physically unfit is greater than it was, owing to the increased preservation of delicate and weak individuals, but that the real underlying cause of the great bulk of pauperism and of its increase in recent years is mental inadequacy, a want of grit and independence. He thinks that environment has often fostered this deterioration by providing indiscriminate help, by creating artificial wants, and by failing to teach thrift and prudence, but that the root cause is *inherent* weakness of will and character, leading the individual to always take the line of least resistance.

This brings us to another set of facts illustrating the disappointing results of our improvement of environment—the facts about the *feeble-minded.* In 1908, the Royal Commission on the Feeble-Minded estimated that there were 150,000 notably defective persons in England and Wales, exclusive of certified lunatics in asylums, and that nearly half of the whole number of feeble-minded were unprovided for and therefore a danger to society. Until lately, the number of the feeble-minded was not known. The number of the insane, or lunatics, as shown by the reports of the Lunacy Commissioners, has greatly increased of late, but this may be due to the greater tendency to send the insane to asylums, and to better methods of keeping them alive. Hence much of the *increase* of insanity is probably not real, but only apparent, but it does seem as if there has been no *decrease*, and the existing quantity is disappointingly large.

There is a difference between insanity and feeble-mindedness which is worth remembering, namely that insanity is sometimes due to disease or special strain, though most of the insane have an inborn nervous weakness ; still insanity *may* be temporary and curable. Feeble-mindedness, on the other hand, is permanent and incurable, and in a very large percentage of cases it is inherited from the parents. Twenty-five out of thirty-five witnesses who gave evidence before the Royal Commission attached supreme importance to this fact ; e.g. Sir Clifford Allbutt said, "I regard feeble-mindedness as hereditary. . . . Feeble-minded persons are prolific ; the thing can only be bred out," and an instance was given of a feeble-minded woman who had four feeble-minded daughters, all of whom had feeble-minded children, and at the time of the investigation, the descendants of the original woman included more than one hundred feeble-minded people. The Commissioners, in summing up, emphasised three points :

1. The hereditary nature of feeble-mindedness.
2. That prevention ot the mentally defective from becoming parents would tend largely to diminish their numbers.
3. That the mentally defective should not live at large, but in institutions.

In connection with this, it is, of course, notorious that many feeble-minded men and women drift into workhouses before reaching the age of thirty, and that in the numerous maternity cases amongst the women a very large number of the births are illegitimate.

There is also a considerable connection between *prostitution* and feeble-mindedness ; e.g. out of 15,000 women who passed through various Homes for Prostitutes in England, sixteen per cent were definitely feeble-minded, and this is probably an underestimate ; also this sixteen per cent had added 1,000 illegitimate children to the population.

Again, *crime* is connected with mental defect. According to the late Dr. Goring and other authorities, a well-marked characteristic of the criminal class, excluding those convicted of fraud, is their mental defectiveness or stupidity. There is absolutely no doubt that mental defect is hereditary, and this means that there is a class of criminals who should not be allowed to hand on their characteristics to children. Sir H. B. Donkin estimates that twenty per cent of our criminals are of primarily defective mental capacity, and the examination of the children in one industrial school showed that seventy-five per cent were defective. The doctor of a large prison where boy offenders are admitted thinks forty per cent are feeble-minded.

Then, again, a good deal of *chronic drunkenness* is probably due to feeble-mindedness. Dr. Branthwaite, Inspector under the Inebriates Act, states that this is so, and Dr. Mott, Pathologist to the London County Asylums, says that the weak-minded react to alcohol more readily than do normal people. Probably the statement that *was* so often made, to the effect that alcoholism accounts for much insanity (sixteen per cent) and mental weakness, is a putting of the cart before the horse. The Royal Commission gave sixty-three per cent of habitual drunkards as defective. Other authorities give seventy per cent.

The presence in a community of pauperism, crime, chronic alcoholism and mental defect is, of course, a very heavy burden on that community, as well as a danger to future generations. As an example of their expensiveness, take the case of the " Jukes " family in America. Starting from five sisters born about 1760, the family has bred an extraordinary number of mentally defective, criminals and paupers, and has cost the State £260,000 directly and an amount indirectly which is impossible to estimate. The maintenance of all these unfit people falls on the shoulders of the fit, in the form of rates, taxes and charity, and it makes life considerably harder for the fit. Hence some people have begun to wonder if our legislation and charity do not increase rather than lessen the evil, because they make it easier for the unfit to have children, who will inherit the mental and moral defects of the parent.

Another uncomfortable matter for the social reformer is the study of *Infant Mortality*. The Local Government Board issued an interesting Report on this in 1916, showing, amongst other things, the chief causes of infant deaths, and comparing death-rates of babies in different years, going back to 1870. The Report shows that a very large number of children die under one year old, but the percentage has fallen from fifteen per cent in 1870 to eleven per cent in 1915. Now, of the causes of death, *congenital debility* comes first, with thirty-four per cent of the deaths laid at its door in 1911–14, and this percentage has remained practically constant since 1870, i.e. the *decrease* in death-rate is entirely due to improvement in infant care, supervision of midwives, compulsory notification of births, better medical treatment, etc. But, the proportion of deaths from *inborn* defects is as great as ever, and it is one-third of the total.

Closely connected with infant mortality is the *birth-rate*. This has been declining since about 1870, and people are divided in opinion as to whether this is a good or bad thing. The point to emphasise here is that the decline is *differential*.

i.e. greatest amongst the most capable *in all classes* of society, and least, or rather none, amongst the "unfit"; e.g. an investigation by Tredgold, about sixteen years ago, showed that the average number of children per family for the whole population was 4·63, and in a mentally degenerate family 7·3, and the same holds good for the thriftless, incompetent and lazy, compared with the thrifty and competent. (Sydney Webb, Whetham and Heron all confirm this.) This means that, as someone puts it, "the parasitic class is propagating with unbated vigour." If the decrease in births had affected *all* classes of the community equally, the birth-rate of the country as a whole would have sunk below the death-rate, and our population would therefore be rapidly decreasing. Some people consider that eventually the decline in births will reach all classes. It seems doubtful, however, if it will reach the lowest strata.

It has been pointed out by many students of history that a similar differential fall in the birth-rate preceded the decline of Ancient Greece, Rome and Spain. The decline of Spain's great Empire was preceded by the emigration of many of her best and most adventurous men to South America, the suppression of another group by the Inquisition (just those possessing the mental and spiritual independence which made them racially very valuable), and the shutting up of a third group, possessing very desirable moral qualities, in convents and monasteries. None of these could become parents of the next generation, and the result was rapid deterioration, and the modern Spaniard is still described as lacking energy both of thought and action.

In England, we have to remember that, so far, the differential fall in the birth-rate has only been going on for about forty years, and therefore it is not too late to stop it, if it can be stopped. And some people at any rate believe that it is a possibility, e.g. Professor Whetham says, "By the cultivation of a due sense of moral responsibility, by an appeal to the patriotism and foresight of the nation, by a proper adjustment of economic burdens, by a well-considered scheme of deterrent legislation, a nation can control its future composition and history to a much larger extent than has been suspected, and whether it will or no, it is always rising or falling as regards its inherent qualities."

So much for the one set of facts which have helped to stir up the present-day interest in human heredity, and the doubt as to whether our methods of social reform might not be revised. The other great group of facts contributing to this stirring up of interest are those derived from the biological advances which originated with Darwin's work on the Origin of Species. It is probably true to say that this book provided the stimulus which set all modern biological research going, including work on human heredity. Galton, the founder of modern eugenics, definitely says that the publication of Darwin's book marked an epoch in his own mental development, as it did in that of human thought generally, and incidentally he remarks on the perversity of the educated classes in misunderstanding Darwin's ideas, and on the difficulty always attending the introduction of a new idea. He ascribes this difficulty to the fact that it is uncomfortable to alter one's mental attitude, and probably he felt all the more sympathy with Darwin because a good deal of similar misunderstanding subsequently fell to his own lot, when he tried to revive the idea of race-improvement by way of heredity.

One result of the impetus given to biology was Weissmann's work on "acquired characters." It had always been supposed that these could be passed on from parent to children, till Weissmann pointed out that there was no satisfactory evidence for this, and in 1885 he formulated the theory of heredity which is now accepted practically universally, i.e. the theory of the *continuity of germ-plasm*, which means that the germ-cell of one generation gives rise not only to the body of the next generation, but also directly to its germ-cells, so that the body does not *produce* the germ-cells, but only contains them. Also, no change which does not affect the germ-cells can be inherited. Hence, "acquired characters" are not inherited, or only to a small extent. On the other hand, it is quite probable that environment *can* affect the germ-cells, though *how* they will be affected is unknown. But it is a fact, proved biologically, that very many changes produced in the parent by environment are without any influence on the germ-cells—and hence on the race (Dr. Saleeby). And therefore more can be done in a few generations by making conditions favourable for the reproduction of innate qualities which are certainly transmitted than could be done in long ages by environment.

Next, in 1900, Mendel's work on heredity was re-discovered, simultaneously and independently by several biologists (De Vries in Holland, Correns in Germany, Tschemak in Austria). Mendel was Abbot of the monastery of Brünn, in Bohemia, and published his most important paper in 1866, i.e. seven years after Darwin published the *Origin of Species.* Somehow or other Mendel's work was lost sight of, possibly because people's minds were so preoccupied with Darwin's ideas. The central fact proved was that certain characters in plants are distinct units, inherited independently of each other. Later work along Mendel's lines has resulted in the discovery that his conclusions also apply to some animal characters, including certain human peculiarities, such as eye-colour, colour-blindness, congenital cataract, right and left-handedness, though none of these characters are in themselves important. However, the further study of Mendelian inheritance will probably elucidate the lines along which practical eugenics should proceed.

I have tried, so far, to indicate the factors which gave rise to the modern interest in heredity and to its inclusion as a factor influencing racial qualities. Now, practically, *eugenics* has come to mean the study of how we can apply the facts of heredity for the betterment of the race. The official definition of the word eugenics can be interpreted as including the study of both environment and heredity, but the eugenist does not at present trouble much about environment, because so many other people are willing to do that, and what needs emphasis is the other factor which has hitherto been ignored. It is *not* that the eugenist thinks environment unimportant. It is obviously of very great importance, in that bad soil may spoil good seed, and so it seems waste of time to argue about whether environment or heredity is the more important.

At this point a very brief outline of Galton's work and ideas is of interest, since he was the founder of modern eugenics. He was himself a member of a family which produced a great number of brilliant thinkers. His maternal grandfather was Dr. Erasmus Darwin, physician, poet and philosopher, and the grandfather also of Charles Darwin. So Francis Galton was second cousin to Charles Darwin. He is chiefly famous for his work on heredity. His first papers on this subject appeared in 1865, in *Macmillan's Magazine*, and contain the germs of his later work on eugenics. Galton, however, says in his *Memories* that " popular feeling was not then ripe to accept even the elementary truths of hereditary talent and character upon which the possibility of race-improvement depends. Still less was it prepared to consider dispassionately any proposals for practical action. So I laid the subject wholly to one side for many years. As in most other cases of novel views, the wrong-headedness of objectors to eugenics has been curious. The most common misrepresentations now are that its methods must be altogether those of compulsory unions, as in breeding animals. It is not so. I think that stern compulsion ought to be exerted to prevent the free propagation of the stock of those who are afflicted by lunacy, feeble-mindedness, habitual criminality, and pauperism, but that is quite different from compulsory marriage. How to restrain ill-omened marriages is a question by itself, whether it should be effected by seclusion or in other ways yet to be devised that are consistent with a humane and well-informed public opinion. I cannot doubt that our democracy will ultimately refuse consent to that liberty of propagating children which is now allowed to the undesirable classes, but *the populace has yet to be taught the true state of these things.* A democracy cannot endure unless it be composed of able citizens ; therefore it must in self-defence withstand the introduction of degenerate stocks.

What I desire is that the importance of eugenic marriages should be reckoned at its just value, neither too high nor too low, and that eugenics should form one of the many considerations by which marriages are promoted or hindered, as they are by social position, adequate fortune and similarity of creed. I can believe hereafter that it will be felt as derogatory to a person of exceptionally good stock to marry into an inferior one as it is for a person of high Austrian rank to marry one who has not sixteen heraldic quarterings. I also hope that social recognition of an appropriate kind will be given to healthy, capable and large families, and that social influence will be exerted towards the encouragement of eugenic marriages.

Confusion is often made between *statistical* and *individual* results. It sometimes seems to be held seriously that if the effect of a particular union cannot be accurately foretold the application of the rules of eugenics is vain. This is not the case. Statistics give us assurance concerning the fate of such or such a percentage of a large number of people which, when translated into other terms, is the probability of each of them being affected by it. From the statesman's point of view . . . this information is sufficient. It tells how large a number of undesirables or desirables can be introduced, or not, into a population by such and such measures."

In 1869, Galton published his *Hereditary Genius*, in which he showed that instead of men being born equal they had very different abilities, even when training and opportunity were the same; e.g. he took the results of the Cambridge Mathematical Tripos and showed that they represented difference in mathematical ability of 30 : 1. Charles Darwin, writing to Galton apropos of this book, said, "I have only read about fifty pages of your book . . . but I must exhale myself, else something will go wrong in my inside. I do not think I ever, in all my life, read anything more interesting and original."

Galton wrote another book in 1884, called *Inquiries into Human Faculty*, now published in Everyman's Library. One of the most interesting chapters in it is that on the "History of Twins," in which he shows that twins supply us with a convenient method of comparing the relative strengths of heredity and environment. Twins born very much alike, but brought up under different circumstances, remained alike both in body and mind, whereas twins who differed at birth, but were brought up under exactly *similar circumstances*, yet remained different. Hence he concludes that Nature is stronger than Nurture.

Later, Galton founded a Eugenics Laboratory in the University of London, under the direction of Professor Pearson. That laboratory collects family histories and statistics of various kinds and issues a quarterly magazine called *Biometrika* and a series of interesting lectures and memoirs.

Now, as to the practical proposals put forward by eugenists. In 1901, Galton said of eugenics, "It is smiled at as most desirable in itself and possibly worthy of academic discussion, but absolutely out of the question as a practical problem." In a lecture given in 1904, he says that there are three stages in the development of eugenics :

1. It must be made familiar as an academic question.
2. It must be recognised as a subject whose practical development deserves serious consideration.
3. It must be introduced into the national conscience.

With regard to the first and third stages, the Eugenics Education Society has been formed expressly to spread knowledge, in a popular form, of what eugenics is, because it can only be made a real force by enlisting public opinion on its side. As Major Leonard Darwin says, "If we could get the paramount racial duty which we owe to posterity incorporated as an essential part of the moral code of the nation, then we should be on the high road to success."

Galton's second stage involves consideration of *practical* action, and here all sane eugenists agree that we do not *yet* know enough of the laws of heredity to justify legislation except in extreme cases, but they hold that we *do* know enough to keep us very well occupied till the study of heredity provides further data. Practical proposals can be classified as positive and negative. Some people add a third group, the "preventive."

Positive proposals aim at encouraging worthy parenthood. Galton suggested that societies might be formed to collect funds for starting young couples of "worthy" qualities in their married life and helping them and their families a critical times. Another suggestion, and perhaps a mor practicable one, is that we should welcome the right type c immigrant and discourage the wrong type. As it is, we le them all come, though we are the only nation that does sc Neither our Colonies nor other countries will accept th "unfit" from us, though they *do* accept 200,000 able an healthy emigrants annually from us. We, on the other hanc receive the off-scourings of other countries, and these ar racially very undesirable. A third proposal is for differentia taxation, according to the number of children, and here w have made a beginning, for income-tax is rebated to a sma extent in consideration of wife and children. Also, th incomes of husband and wife ought to be reckoned *separatel* for income-tax, instead of being *added* together, as is done a present, the result being that a very much higher rate of ta has to be paid; i.e. marriage is penalised. Also scholarship for children of large families or bonuses at fourteen migh deprive some racially desirable classes of the argument tha prudence demands a small family. A fourth suggestion i that we should try to build up a spirit of self-sacrifice in th people who in the past did and in the present could hav fairly large families. As Dr. Ballantyne says, "The extr baby must be weighed against the motor-car, and recognise as of more value." A fifth suggestion is that we ought to tr to do away with *wages* which do not admit of decent rearin of a family, and with *housing conditions* which have the sam effect. These proposals imply, of course, that the fallin birth-rate is undesirable.

However, the line along which, in the present state of ou knowledge, most profitable work can be done is that of negative eugenics, i.e. *the discouragement of unworthy parenthoo* Directly we know that a defect is transmissible, we also kno that its possessor, from the racial point of view, ought not t have children. Compulsion is not possible always, but if w had succeeded in developing a "eugenic conscience" in tha person, we *could* appeal to that conscience, and here comes the value of educating public opinion. But, apart from the cases, directly we come to mental deficiency we have a su foundation for practical action, and recognition of that fact has already brought about a step in the right direction, viz. the passing of the Mental Deficiency Act which came into force in April, 1914, and made it legal to detain mentally deficient children *for life* in institutions. The essential point, of course, is that in such institutions marriage is not allowed, but the individual lives a very much happier life in them than if left to drift along in the world. Until 1914 a defective child could be forced to attend a special school till the age of sixteen, but then he was free to live at large, and the result almost always was disaster. The small results produced by the defective school disappeared in a short time after leaving, and the boy or girl drifted into immorality, drink, pauperism, and crime, and handed on the mental defect to a particularly large number of descendants. It was the *wastefulness* of energy and money involved by special schools under these conditions that partly explains why Local Authorities have been so unwilling to build them. We have at present about 30,000 defective children capable of some sort of education, but schools for only half of them. As to institutions for life-long care of the feeble-minded, the actual provision is almost a negligible quantity compared with the need; but one must remember that the Mental Deficiency Act had only been in force for three months before the war broke out and put a stop to all internal reforms. One hopes that a good deal will now be done in this matter of providing institutional care. The cost will be great, but we should probably be repaid in a couple of generations by the saving on asylums, prisons, reformatories, special schools, workhouses, inebriate homes, and so on, and by the gain in production of goods owing to the setting free for other work of the army of officials now employed to look after the unfit.

Other and less costly methods of preventing the propagation of the unfit exist, and have been tried in America, though I do not know if the experiments have gone on long enough to show results; but the *segregation* method is the one most in accord with present-day public opinion in England.

A point to remember is that segregation alone will never completely stamp out mental defect, because the group of diseases known as *venereal or social* cause mental deficiency in the children, and until we deal with those diseases we shall always have fresh cases of mental defect arising. Hence the group of proposals under the head of "preventive eugenics."

Epilepsy is another disease which is definitely hereditary in a good many of its forms, and epilepsy and feeble-mindedness are interchangeable, i.e. an epileptic may have feeble-minded children, *or* conversely a feeble-minded parent may have epileptic children. Hence the hereditarily epileptic ought not to have children.

Another practical point is our present method of letting patients out of asylums directly their symptoms disappear. They are said to be cured, but often their power of handing on their mental defect is *not* cured, and as soon as they are sent out into the world, therefore, they become a racial danger. It has been suggested that sterilisation might be tried in these cases.

A third disease which is hereditary in one of its forms is *deaf-mutism*, and so all remarks applying to mental defect apply here also.

A fourth practical suggestion is that we should alter our method of dealing with the criminal. As many are mentally defective they should be prevented from parenthood, but at present such criminals are often subjected to *many short terms* of prison, and between whiles propagate their kind. Hence the habitual criminal should be segregated for *long* periods. Dr. Goring finds that the children of the criminal are ten times more likely to turn out criminal than are the children of normal parents, and the moral surely is, Do not let the criminal be a parent. Actually this could be done by treating the mentally defective criminal under the Mental Deficiency Act, instead of under the Criminal Laws.

A fifth suggestion is that tramps should be sent to Labour Colonies—to give them a chance of reforming, and if incurable they could be detained or otherwise dealt with so as to prevent reproduction.

A sixth suggestion is that all doctors should have to learn the laws of heredity. At present many have "a bundle of prejudices instead of systematic knowledge."

There are some *objections* to eugenics which crop up fairly often, and perhaps therefore might be mentioned.

1. One is the idea that belief in heredity is a fatalistic, hopeless sort of creed which saps effort and the sense of personal responsibility and freedom. It surely need not, for here the value of training and environment comes in most hopefully for the individual. Even though you cannot make a silk purse out of a sow's ear, you *can* make various other useful things out of it. Also "forewarned is forearmed." If we know our weaknesses we can guard against them, and so we are *more*, not less, responsible for ourselves and for the race.

And as to heredity being a depressing sort of business, here we all need to lay more stress on the inheritance of the *good*, as well as of the bad. We talk more about the latter because we know better how to stop it than how to promote the inheritance of the good, and we are inclined to forget the things we have to be grateful for.

2. A second objection is felt by some Christians, who feel that there is an antagonism between religion and eugenics. And this also surely need not be. As Dr. Lyttelton, the late Head of Eton, says, Christianity, more than any other power, has given us the sense of the infinite value of human life, and the eugenist is trying to prevent the wreckage of human life. Dr. Lyttelton goes on to say what a help it is to a teacher who is trying to implant eugenic ideals in a pupil, if that pupil already has the idea of the Fatherhood of God. If so, he is ready to understand the preciousness of human life and to shape his conduct in conformity with that idea. If, on the other hand, the pupil has no personal religion, it is a very difficult thing to implant the idea of the value of life.

APPENDIX

APPENDIX I

VITAMINES AND DIET

In England we mostly eat a fairly varied diet, and in it get *some vitamine but not nearly enough*—and this is because we hardly eat any natural food, i.e. food that has not been altered or added to by the things done to it before we eat it. The result is much ill-health, shown by our feeling tired, depressed, run-down, headachy, and by our sufferings from indigestion and constipation—these two last leading on to worse evils in the form of appendicitis, ulcers in stomach or intestines, and cancer in the same organs.

It is now recognised that there are four different vitamines, called A, B, C and D respectively ; each producing different effects and *all four necessary*.

Vitamine A occurs in animal fats (e.g. butter, cream, suet, cod-liver oil), eggs, the internal organs (e.g. heart, liver, kidneys) and green vegetables. Bacon-fat and lard are exceptions, containing *no* vitamine.

Vitamine A is essential for growth and resistance to infectious disease.

Vitamine B occurs in the whole grain of wheat, rye and other cereals, in pulses (dried peas, beans and lentils), nuts, yeast, eggs, and the internal organs of animals. " Marmite " is an extract of yeast, full of vitamine B, and so is a valuable food as well as being pleasant in taste.

Vitamine B is essential for growth and for prevention of certain diseases, such as beri-beri in man and similar diseases in animals.

Beri-beri is a disease of the nervous system, and is marked by wasting, loss of sensation in the skin, paralysis, etc., often ending in death. It is rare in Europe, where a varied diet usually ensures that some vitamine B is eaten, but it is common in parts of the tropics, especially where rice is the main food, as in Japan, the Philippines, and the Malay Peninsula. It is due to the " polishing " of the rice, i.e. the removal of the entire husk and germ (or embryo) which are the parts of the grain containing vitamine B. Where unmilled or home-milled rice is eaten, the disease does not occur, because the germ and husk are not completely removed in this case.

Vitamine C occurs in fresh juicy fruits, fresh green vegetables, and in *some* root vegetables, e.g. swede. Potato and onion are fair, whilst white turnip, beet-root and carrot are poor in this respect.

Vitamine C is essential for preventing scurvy, a disease which used to be far commoner than it is nowadays, and which especially attacked sailors and others who went on long voyages, during which they had no *fresh* food. It is a horrible disease, in which the whole body becomes sore, the gums swell and ulcerate, the teeth fall out, great weakness sets in—and often, in the past, it ended in death. This scourge was conquered, as regards sailors, when Captain Cook discovered, towards the end of the eighteenth century, that a supply of oranges and lemons was a preventative.

Vitamine D is found in animal fats, e.g. cod-liver oil, and can be artificially produced in various other substances by exposing them to sunlight *or* to the light from specially constructed electric lamps. It is thus possible to add vitamine D to various foods, such as milk, margarine, etc.

This vitamine enables the body to assimilate calcium and prevents rickets. An interesting point is that vitamine D is produced in the natural grease of the human skin, by sunlight, and the blood can absorb this vitamine from the skin. We thus get an explanation of part, at least, of the benefit of sunlight to the body.

Now let us consider our usual diet :

(1) Our " staff of life," which might more reasonably be called a broken reed, is white bread, i.e. bread from which the husk and germ have been removed and with them all the vitamine, proteid and salts ! The extravagance and absurdity of this modern fashion in food needs no further comment—but there is a word of warning wanted. Make sure that your brown bread is *wholemeal*—for brown bread *can* be made by using refuse and poor wheat, and this one wants to guard against. Hence interview the baker and find out what he uses—or get a guaranteed make.[1]

(2) We eat quantities of tinned and salted and potted meats, custard powders, pastry, rice, sago, tapioca, cornflour, jam and sweets, none of which contain any vitamine.

(3) We eat comparatively little fruit and vegetables—and even what we do eat is largely spoilt by cooking with too much water, for too long, and with soda. Too much water dissolves vitamine B out of the vegetables and it is flung away with the water. The way of wisdom is to use very little water and keep it for use, or to steam the vegetables. Potatoes should be cooked in their skins as this prevents loss of vitamine, proteid and salts. Long cooking, as in stewing or hay-box, destroys vitamine C—and so does soda. Hence cook vegetables for as short a time as possible. Raw fruit and vegetables are more valuable than cooked, and if we can teach children to spend their pocket-money on fruit instead of sweets, we shall be doing them good service.

In this very short discussion of a big subject I have tried to show that it is not difficult for a mother or housekeeper to so choose the food for her family as to avoid the mistakes which cause so much unnecessary illness to-day. The worst of these mistakes are probably the use of white flour, too much meat and sweets, and too little fruit and vegetables. Surely it is worth while to make the effort to get out of a rut when one realises how much is at stake.

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[1] The following firms guarantee their wholemeal flour and bread : Allinson, Ltd., Hovis, Ltd., Keyes' Daren Mills, J. & B. Stevenson, Ltd.

APPENDIX II

CONSTIPATION

Doctors are more and more coming to the conclusion that constipation is the cause of many of the diseases of the stomach and bowels which are so dreadfully common in civilised countries. Appendicitis, ulcers and cancer are instances of such diseases. In countries where, owing to different and more natural food, constipation is almost unknown, these diseases of stomach and intestines are also almost unknown.

APPENDIX III

INFLUENZA AND SLEEPY SICKNESS

Influenza caused 8,461 deaths in 1923. It occurs in epidemics, the infection spreading from the breath, coughing, sneezing and discharges from nose and mouth of the patient. The germ enters by way of nose, mouth or eyes.

Incubation may be only a few hours but is usually about two days.

Symptoms are usually headache, aching of back and limbs, shivering, rise of temperature, perspiration. There may also be the symptoms of a common cold, such as sneezing and running at the nose. The germ may also attack the digestive system, causing sickness and diarrhœa. When the temperature comes down, the patient is left very weak and depressed. Bronchitis and pneumonia may develop, in which case the illness is very serious indeed.

Treatment. In any case it is wise to take influenza seriously, to go to bed at once; send for the doctor and stay in bed for three or four days after the temperature becomes normal. Isolation is necessary for ten days in ordinary cases and for longer in severe cases. It pays to take as long a time for convalescence as possible; if one gets about too soon, as most people do, one may feel the effects for months.

Sleepy Sickness (Encephalitis lethargica) is a disease which has only risen into notice in this country during the last few years. It has been notifiable since 1919, and in 1928 there were 1,072 cases. Rather more than half the cases die, as a rule, and the after-effects on the survivors are often very serious, including mental and moral weakening, lack of self-control, paralysis, and other physical effects.

The commonest symptom is lethargy, gradually increasing to stupor. Sight and speech are affected, and giddiness and facial paralysis often occur. Sometimes instead of lethargy great excitement is present.

The disease is being studied, but much remains to be discovered about it.

APPENDIX IV

PREVENTION OF DIPHTHERIA

A GREAT advance in our knowledge of how to prevent diphtheria has sprung up in recent years from the use of the *Schick test*. In 1911 Schick showed that, if a small quantity of diphtheria toxin were injected into the skin of the arm of a person susceptible to the disease, in two or three days the skin would turn dark red in colour over a patch of ½ to ¾ of an inch in diameter, around the place of injection. On the other hand, no effect was produced in an immune person. Hence we can thus discover which persons are susceptible and which are immune.

Now scientists had already discovered, by experiments on lower animals, that a mixture of toxin and antitoxin rendered these animals immune to diphtheria, but they had hitherto hesitated to experiment on man. However, encouraged by Schick's discovery, von Behring, a German, showed that toxin-antitoxin mixture was harmless to man, and after the War his discovery was developed in America by Dr. Park and his colleagues. They applied the Schick test to thousands of children in New York and followed it up by inoculating the susceptible children with toxin-antitoxin. The result was that these children became immune, the immunity developing gradually and being complete after a period of three to six months. This shows that the method cannot be used for the immediate control of an existing outbreak of diphtheria, but when immunity is once established it seems to last indefinitely. Clearly we have here a method of rendering the whole population immune to this particular disease, and Sir George Newman says, in his report to the Ministry of Health for 1924, that we ought to consider the question of making this method of protection against diphtheria more generally available for the children of this country.

A good deal has already been done on these lines in Edinburgh, where in 1922 Dr. Kerr began to immunise his hospital-nurses with toxin-antitoxin, with such good results that in two years the amount of diphtheria amongst the nurses was reduced by 80 per cent. In 1923 a start was made in a large residential institution for children, and in 1924 a campaign was begun in the Board Schools. During the year the parents of a large number of children were given this opportunity of having their children immunised and consent was given for 43 per cent of these children, the best response being from the better-educated classes of the community. 4,362 children were Schick-tested and roughly 2,000 were found to be susceptible, and nearly nine-tenths of these were completely immunised. Children under five are dealt with at one of the Child-Welfare centres.

At Brighton also, all children resident in institutions can be immunised free of cost, and any mothers applying at an Infant-Welfare Centre can have their children immunised similarly. In the fever hospitals all susceptible nurses are immunised.

Birmingham is also beginning Schick testing and immunisation in the Maternity and Child-Welfare Centres.

Two interesting facts brought out by the above investigations are that children of higher social status are more susceptible than those of lower social position, and younger children are more susceptible than older ones.

By 1928, fifteen local authorities in and around London and fourteen in the rest of the country were offering facilities for immunisation.

APPENDIX V

RECENT DEVELOPMENTS IN THE CAMPAIGN FOR CLEAN MILK

In 1923 the Ministry of Health issued a Milk Order, for *grading* milk into four definite classes, called respectively, *Certified*, *Grade A* (*tuberculin tested*), *Grade A*, and *Pasteurised*. The milk dealer may not use any of these names for his milk unless he has a licence from the County, Borough or District Council.

Certified Milk is from a herd of cows none of which is tubercular and which is examined by a veterinary surgeon and tested with tuberculin every six months. The milk is bottled *raw* on the farm, immediately after milking, and each bottle is closed with a tight cap bearing the name and address of the producer, the date, and the words " Certified Milk." It costs about twice as much as Pasteurised milk and so is beyond the means of poor people.

Grade A (*tuberculin tested*) milk is produced under the same conditions as certified milk, except that it can leave the farm in sealed unventilated churns instead of bottles. It may be taken to a dairy and bottled there, but both churns and bottles carry the name and address of the dealer, the date, and the words " Grade A (tuberculin tested)." In some places it is sold at 1d. per quart above the price of ungraded milk ; in others it costs 2d. or 3d. a quart more.

Grade A milk is from a herd of cows examined every three months by a veterinary surgeon, so that any cow showing signs of disease which may affect the milk may be removed from the herd, but the cows are not tested with tuberculin. The other conditions are as for " Grade A (tuberculin tested)," but the words "(Tuberculin tested ") are omitted from the label.

Pasteurised milk is defined as milk which has been heated to a temperature of 145° to 150° F. for at least half an hour, and then immediately cooled to 55° F. or lower. It is often sold at the same price as ungraded milk.

In all four grades there are regulations as to the maximum number of bacteria permitted ; e.g. in Certified milk there must not be more than 30,000 bacteria per cubic centimetre ; in Grade A milk not more than 200,000 bacteria per cubic centimetre ; and in Pasteurised milk not more than 100,000 bacteria per cubic centimetre. Further, in Certified milk there must be no coliform bacillus in $\frac{1}{10}$th cubic centimetre, and in Grade A milks no coliform bacillus in $\frac{1}{100}$th cubic centimetre. These numbers give one some idea of how germs swarm even in pure food.

Not many farms produce " Certified " milk at present ; more produce " Grade A " milk, and Pasteurised milk is fairly easy to obtain in towns — but beware of thinking that milk is graded because it is in a bottle, for this does not follow in the least. You must examine the label on the bottle and make sure that it bears one of the four lawful designations if you want to be sure of getting graded milk.

In 1926 the " Milk and Dairies Order " came into force, and this was a further step towards ensuring the purity of milk. The Order provides that all dairies and dairymen must be registered by the Sanitary Authority, and every County or County Borough Council must inspect milking cows. Cowsheds must be properly lighted and ventilated, kept clean, and whitewashed in May and October. Milk must not be kept in a room used as a kitchen, scullery, living-room or bedroom, or in any place where it is likely to be contaminated. Every person who handles milk in any way must keep himself and his clothes clean. The dairyman must report to the Medical Officer of Health if any person in his employ or anyone in the household of himself or of an employee has an infectious disease, and the Medical Officer of Health may forbid the sale of the milk. All vessels containing milk must be thoroughly cleansed with boiling water or steam, and the milk must be covered, to protect it from dust, dirt, and flies. The cow's udders must be cleansed before milking The churns in which milk is distributed must be unventilated.

APPENDIX VI

SUNLIGHT, ARTIFICIAL LIGHT, SMOKE AND HEALTH

In the last few years there has been a great deal of scientific investigation of the effect of sunlight on health. Professor Finsen in Denmark, Dr. Rollier in Switzerland, and Professor Leonard Hill in England are amongst the pioneers of this work, and they have proved quite conclusively that light has the most wonderful curative effect on certain diseases, especially tuberculosis of skin, bones, glands, etc., rickets, and wounds. The light not only kills germs but has a tonic effect on the whole body and mind, making the patient more lively and cheerful, improving appetite, digestion, and circulation of the blood, so that the muscles develop properly and the body is able to resist cold far better than before. In Switzerland, Dr. Rollier's patients work and play out-of-doors, sometimes on snow, wearing only hats, boots, and loin-cloths. In England we cannot, unfortunately, rely on natural sunlight altogether, and so artificial light is often used from electric lamps, of special make. Both as a cure and as a preventive of disease, light is being more and more widely employed, and in 1930 we had sixty-eight artificial-light clinics, under Local Education Authorities, for treatment of school-children. The results show that the chief value of this treatment lies in its tonic effects on debilitated children, especially on those convalescent from illness or showing nervous instability. It is also useful for enlarged glands and for some forms of skin disease, e.g. lupus and alopecia. But one must warn parents and others against the mistake of thinking that artificial light does away with the need for real sunlight, good food and all the other factors which make up a healthy environment.

It stands to reason that we ought to plan our schools, our homes and our lives so as to get the greatest possible amount of this health-giving light—but now we come to the obstacles. These obstacles are chiefly two—the planning of our buildings and smoke, both fortunately remediable, though not easily so. As regards our buildings, we want to avoid the crowding of too many on to a given area of land and the tall many-floored tenement-type of dwelling, since as a rule the occupants of these have very little chance of a garden or of sending their children to play out-of-doors safely. Moreover, we want to do away with ordinary window-glass, because it cuts off the ultra-violet rays of the sun, and these are the most valuable of all for health. In place of ordinary glass the ideal is " vita-glass " (as made by Messrs. Chance Bros. & Co., Smethwick, Birmingham), for this allows the ultra-violet rays to pass through it. It has been tried with much success in some schools (e.g. Crockets Lane School, Smethwick, and King Edward's Grammar School, Birmingham), in some hospitals (e.g. Croydon and Newton Abbot), in some hotels (e.g. the Savoy, London, and the Haven Hotel, Sandbanks), in some offices and private houses—*and*, in the monkey house, lion house, and reptile house at the London Zoo. One hopes that it will soon become the rule rather than the exception in all windows. The only drawback, at present, is the cost.

As regards *Smoke*, we are so used to it that few of us realise that in our manufacturing towns there is a constant curtain of smoke between us and the sun, and that this smoke-pall cuts off a great deal of sunlight, especially the ultra-violet rays, which, as we have already said, are so valuable. Not only are the health and spirits of the whole community thus injured, but much harm is done to plant-life and to buildings, and the work of keeping houses and clothes and bodies clean grows to be a burden too heavy to be borne—at least by many a hard-worked housewife. And the smoke evil is not confined to industrial towns, for the ordinary dwelling-house chimneys are, *en bloc*, worse sinners than the factory chimneys.

Now, is all this inevitable? I think not, and the opinion is based on that of many expert authorities who have proved that scientific methods of combustion in factories and houses can do away with black smoke. Much has been done in various towns in America and Germany to reduce smoke, and the increasing use of gas and electricity both in industry and in our houses is a good sign. It is also possible now to buy solid smokeless fuel, made by low-temperature carbonisation of coal at gas works and other places, and one hopes that soon gas, electricity, and smokeless fuels will oust raw coal from our grates.

Some attempts have been made to mitigate the factory-smoke nuisance by law, and a new Smoke Abatement Bill was brought before Parliament in 1926, but whether it will be effective or not remains to be seen. Previous legislation has largely failed because it was so full of loopholes through which offenders could escape—and none has attempted to tackle the problem of dwelling-house smoke.

APPENDIX VII

THE Public Health (Preservatives, etc., in Food) Regulations, 1925 to 1927, lay down exact rules as to the kinds of food in which preservatives may be used, and as to the kinds and amounts of preservatives or colouring-matters permitted. These provisions came into force between January 1927 and July 1928, and the chief are as follows:—

(1) "Preservative" means any substance capable of preventing or retarding or stopping food from fermenting, acidifying, or in any other way decomposing—or of masking the signs of putrefaction. It does *not* include common salt, saltpetre, sugars, acetic acid or vinegar, glycerine, alcohol, lactic acid, herbs, spices or oils used for flavouring.

(2) The only preservatives allowed are sulphur dioxide and benzoic acid and their derivatives. These are only allowed in a few foods, notably sausages, fruit, jam, pickles, cornflour, coffee-extract, sweetened mineral water, fruit-juices, wine, beer.

(3) In the case of some of the above foods, the presence of preservative must be declared (e.g. sausages, coffee-extract, pickles and sauces).

(4) The addition of certain colouring-matters to food is forbidden, e.g. compounds of copper, arsenic, lead and other metals, and certain vegetable and coal-tar colours.

APPENDIX VIII

THE AUDIOMETER

This is an instrument invented by Dr. Harvey Fletcher of New York, consisting of a gramophone which transmits the sound of the record placed on it to a number of single head-phones instead of through the ordinary horn. As many as forty of these head-phones can be attached to the gramophone, and thus forty children can be tested simultaneously.

Standardised records are used, consisting of series of numbers, spoken in an ordinary voice but graded in loudness.

With an ear-phone attached to each ear *successively*, the child is asked to write down what he hears, and from these written records the hearing of each ear can be assessed.

This method is superior to the whisper in various ways: (1) it is quicker, because a number of children can be tested simultaneously; (2) the loudness of the sounds used is constant and does not vary as whispers may; (3) there is no possibility of lip-reading.

The audiometer is not meant for use by the doctor at his routine inspection but is best used by the school-nurse some days before the inspection, and then the children whose hearing is found to be defective can be further examined by a doctor.

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